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"I cannot help plead to my countrymen, at every opportunity, to cherish all that is manly and noble in the military profession, because Peace is enervating and no man is wise enough to foretell when soldiers may be in demand again."—SHERMAN.

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INDEPENDENT PATROLS: A REQUIREMENT OF MODERN ARMS AND SMOKELESS POWDER.*

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IT is generally admitted that, in battle, the leader who is the stronger at the proper moment at the decisive point, and who has succeeded in bringing his troops, in as complete tactical units as possible, up to or into the enemy's position, without having suffered considerable losses, has the best chances of success. These are maxims universally known.

Clausewitz has truly said: "In war everything is simple, but to secure simplicity, there lies the difficulty." The problem to be accomplished to secure the best chances of success is then simply this: To ascertain the decisive point and to attack there at the proper moment with superior force. Apparently simple and yet how difficult of achievement.

Military history informs us that the introduction of improved arms has at all times produced very material modifications in the method of fighting. The flint lock, percussion cap, rifle, and breech-loader have each necessitated changes. Only a war of

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considerable magnitude will determine what further changes will be wrought by modern artillery armament, small calibre rifles, and smokeless powder.

In the meantime much has been written on the influence the improvements in the armament will have on tactics. The relative advantages and disadvantages of the new powders have been extensively dwelled upon. England, France, and Austria contend that the defensive has gained relatively far more than the offensive and that the advantage is decidedly on that side, while Germany clings to its traditional idea, maintaining that the attacker has the advantage over the defender irrespective of the weapons with which the troops are armed, and indorses the words of Suwaroff: "It is not the gun but the man behind it which signifies." Too much weight is often attached to a perfect mechanism and sight is lost of the importance of "the man behind the gun."

Captain F. N. Maude, late R. E. British army, author of "Letters on Tactics and Organization," has expressed himself to the effect that "It has always been my conviction that the essential principles underlying the employment of troops in war never change; inventions may modify, for a time, the balance between the three arms, and an exceptional weapon in the hands of one army only may temporarily bring about a startling change in the phenomena of the battle-field, as in 1866 and 1870, but once the equality of conditions is restored matters revert to their former aspect with effective ranges and distances only increased." And again: "Armament and skill on the part of the leaders being equal, victory, under all conditions of improvements conceivable in weapons, will ultimately remain with the best disciplined troops, and by 'discipline' I understand that quality which is measured by the endurance of loss by troops under fire, having due regard, of course, to the circumstances of time, ground and employment under which the losses were inflicted."

The countries mentioned above who claim that the defensive has gained most by the improvement in fire-arms also prophesy that the combats in the future will be attended with great slaughter and more bloodshed than anything experienced heretofore. If we refer to military history again, we will find

that losses in battle have been directly affected by the discipline of the troops engaged and only indirectly by the arms used. In other words, the higher disciplined troops, possessing "staying qualities" in a greater degree, always sustained and inflicted greater losses. For example, contrast the losses sustained by the Union and Federal armies in the 1st Bull Run, July 21, 1861, and again by the same armies at Gettysburg, July 1st, 2d and 3d, 1863.

BULL RUN.	*Union Army.*	Killed . .	481	2092
		Wounded	1611	
		Missing .	1460	
	Conf. Army.	Killed . .	370	1859
		Wounded	1489	
		Missing .	30	
GETTYSBURG.	*Union Army.*	Killed . .	2834	16547
		Wounded	13713	
		Missing .	6643	
	Conf. Army.	Killed . .	5000	28000
		Wounded	23000	
		Prisoners	8000	

In both battles the forces engaged on both sides were nearly equal; at Bull Run from 28,000 to 30,000 and at Gettysburg from 70,000 to 80,000 men. The loss in the first battle was about one-fifteenth and in the second battle about one-third of the forces engaged. In the first battle the troops fought on both sides till they were tired of it, both sides becoming exhausted after a small number only had fallen. In the second battle, two years later, we had about the bloodiest battle of modern history. The armament had undergone no changes, but in one case we find undisciplined troops (General McDowell had only about 1000 Regular soldiers, hastily gathered from all quarters, and the balance were volunteers enlisted for three months and without training), and in the other case we find well disciplined veterans.

At Vionville in 1870 the French and Germans, both in a high state of fighting efficiency and both armed with weapons below the latest standard, met in a bloody contest and fought

till night put a stop to the slaughter, without either side having gained a decisive advantage.

The troops opposed to each other in the Servian–Bulgarian Campaign in 1885, both armed with better weapons than either the French or Germans possessed, but in a low state of tactical efficiency, when they encountered each other in a fair fight, after a trifling percentage of loss, were nearly equally exhausted.

The recent war between China and Japan, with the trifling losses attendant, considering the inferiority of the Chinese forces in every requirement of efficiency, from capable leaders to serviceable weapons, does not furnish an example in point.

Whatever may be the influence of modern weapons and the new powders upon fighting in the future, there can be no doubt that troops opposed to each other will suffer losses, and under favorable conditions, very severe losses, at far greater distances apart than formerly. To reduce these losses as much as possible and to find means by which to accomplish, with the least possible loss, what, as stated at the beginning of this article, will insure the best chances of success, is at all times a live and burning question among military men. In 1890 there appeared in Berlin in pamphlet form from the pen of the distinguished military writer, General Von der Goltz, author of the well-known work "The Nation in Arms," an article entitled "Independent Patrols—A Requirement of Modern Arms and Smokeless Powder."

That the words and suggestions of so distinguished an authority, of international reputation, are entitled to very serious consideration, I will go further and say, will command very serious consideration by the military profession of all countries aspiring to keep abreast of the times, need scarcely be stated.

The object of this pamphlet is to make clear and illustrate questions connected with smokeless powder and long-range small-arms and to recommend the formation and training of independent patrols for the purpose of carrying on the reconnaissance where the cavalry is forced to leave off, to find the weakest point for attack (the decisive point also in most cases), and to make possible the advance of the troops in rear without being subjected to very great losses.

It is the intention in the following pages to give an outline of the principal portions of the pamphlet and then make such deductions as appear pertinent and admit of application in our service.

The author treats the subject in five parts: First, the necessity for and use of "Independent Patrols" in general; 2d, Independent Patrols in connection with the work of Cavalry; 3d, Independent Patrols in connection with the work of Artillery; 4th, Independent Patrols in connection with the work of Infantry; 5th, Proposed organization and training of these Independent Patrols.

1. Tactics, the author begins, or the art of disposing and manœuvring troops on the battle-field, unlike the ever constant principles of strategy, is dependent upon the weapons carried and even more so, upon the weapons to which opposed. An advance, he continues, without losses and in tactical units, into the hostile position, would carry with it the greatest promise of success, and that opponent, who, at the decisive moment and at the decisive point, is the stronger, has the best chances of being victorious. From this follows the necessity decisively to attack the adversary where he is found to be weak. Such weak points may be his flanks, where to sustain a tactical defeat, may occasion the most unpleasant strategical consequences, or such portions of his front where the character of the terrain prevents the employment of his force to the best and fullest advantage. The increased accuracy and long range of modern arms have correspondingly increased their destructive effects, and troops advancing to the attack will be subjected to heavy losses long before they approach near enough to bring about a decision. The attacker must, therefore, at the points of contemplated attack, inflict greater losses on the defender in an equal space of time than he himself sustains. Such lines of advance and formation must be chosen which will insure the greatest protection against losses. Admitting that the active defensive has undeniably profited most by the introduction of the new arms, resulting in a greater fire effect from a smaller number of rifles, still the advantages of the offensive remain. Prompt action increases one's strength and an active use of troops augments their spirit and morale. Activity and rapidity of action tend to con-

fuse the opponent in divining our intentions. The initiative offensive gives the law to the adversary. Such initiative has nothing in common with that foolhardiness, occasioned by impatience, which despises to weaken the adversary by the employment of long-range fire and the most careful use of the terrain and which attacks with shaken troops an unshaken defender and attempts by brute force and sheer obstinacy to gain a victory, which by a careful and energetic use of all means at disposal might have been secured with less loss and greater certainty.

Troops entering into a modern engagement, resolved to bring about a decision, stake their very existence.

When conditions and circumstances demand it, the stake must not be considered too high, but foresight and deliberation must characterize all action, and losses must be reduced as much as possible. Not every engagement which is possible is also advisable. In order that every commander's initiative be in conformity with obtaining circumstances, such commander should know something of the plans and intentions of the Commander-in-chief, or be able to make the necessary deductions from the progress of operations. When this is the case commanders will be able correctly to judge when an engagement is to be sought and when avoided, when a position is to be held and when abandoned. In the ratio in which fire-arms are improved, tactics has become more and more of an art. Physical courage only will no longer be an all-sufficient requirement in a leader; but men will be required who have given proofs of special qualifications in the art of troop-leading.

Increased effective range of fire-arms has increased the distance at which masses of troops must be kept in rear and has increased also the importance of a most careful preparation for a decisive engagement. The use of smokeless powder makes a more cautious and thorough reconnaissance of the hostile position difficult but also more necessary and important. Powder smoke no longer betrays the defender's troops and so his disposition.

A hundred years ago, when troops were armed with the smooth-bore musket, with an effective range of little over 200 yards, attacks were made in line.

The improved arms of the Napoleonic era made it necessary

to cover the masses with skirmishers who attracted the hostile fire. The column formation was adopted for the troops in rear, to increase their mobility and to enable them better to take advantage of accidents of ground for cover.

The introduction of the breech-loader demanded a further protection for troops in close order. This was accomplished by dissolving battalion columns into company columns. As much importance was attached to the skirmish line as a factor in the combat as had been and was attached to the column.

The next step in advance was the introduction of the magazine rifles and with it the importance of the skirmish line increased while that of bodies of troops in close order correspondingly decreased. The formations employed to bring up the troops in rear of the skirmish line were no longer columns but the less vulnerable lines.

The effect of the present armament (modern artillery, small calibre rifles possessing increased velocity, range, and penetration, use of smokeless powder) is such that even skirmish lines will suffer severe losses as soon as the ground ceases to offer cover. They will be subject to these losses at great distances from the position (as much as 2000 yards) and when they will be unable to return the fire with effect owing to the small target the enemy presents, being intrenched. As a hundred years ago skirmishers were placed in front of the attacking columns to draw the fire of the defender on themselves, so must we now search for a suitable means, a sort of buffet, to interpose between skirmishers and the enemy in order to save or at least prolong their lives.

The destructive effects of the present day armament peremptorily demand that the skirmish line be launched into action only with the greatest caution and when the conditions to success have been assured by an effective artillery fire. Up to this moment separate, numerically weak, but highly intelligent forces must suffice to keep up the combat, draw the enemy's attention upon themselves and by their fire make the advance of the skirmish line to within effective range possible.

The characteristic of modern tactics is therefore: To hold back the masses till the decisive moment and to occupy the enemy during the preparatory stages of the combat with numerically weak but intelligent forces.

To introduce such *élite* troops, which can work independently in the manner and form of patrols, appears to be an urgent demand of the increased fire effect of modern arms.

To show when and how these Independent Patrols might be used, the author assumes that the leaders and men of these patrols have in time of peace received special training and instruction in the work required of them and that every "zug" (platoon) of a company will furnish one such patrol of the strength of one non-commissioned officer and eight men in time of war (here it must be considered that a German company consists of three platoons and is on a war footing 250 men strong). He further assumes that when these patrols act independently, their packs, whenever practicable, will be carried for them, they themselves carrying only their rations and reserve ammunition in their haversacks, to enable them to get along even if separated from their companies for several days; that these patrols will not be employed for the immediate protection of their own companies—that duty will continue to be performed by the ordinary patrols at present provided,—but they will be used to carry on special work under the direction of the officer in command of the whole body of troops to which at the time they belong; and finally that after they have fulfilled their mission they return to their companies.

In the future, all possible means must be employed to lessen the effect of the opponents' fire. Then also, more than ever before, will fog and night be the enemies of the defenders and the allies of the attackers.

The intrenching tool becomes a weapon. Troops intrenched with a free field of fire are, while plentifully supplied with ammunition, almost invincible. Every tactical advantage gained becomes secured as soon as the troops intrench themselves. Constant practice in time of peace in preparing, occupying, and leaving intrenchments in making an advance on a hostile position, will soon dispel the idea that intrenching is dangerous to the less courageous. Even when the leaving of the intrenchments is practiced as much as the occupying of them, the moral disadvantage still attaching to "intrenchments" will soon have disappeared. A careful and conscientious peace training should certainly result in a discipline, before which the "danger" of

cover is reduced to a minimum and with which the sense of duty predominates the instinct of self-preservation.

The times when the heroic spirit of the individual exercised its influence on the progress of the engagement have long since passed. Foolhardy courage must give place to that sense of duty which conquers fear of death and urges every man—from the general to the individual skirmisher—to do his duty to the last moment at the place assigned to him. Where the soldier could formerly, in defiance of death and with a spirit of bravado swing his weapon, he is now exposed for hours, practically defenseless, to the most terrible fire, and he must not waver in his sense of duty. The moral education of troops gains materially in importance by the frightful effect of modern arms.

The perfection attained in fire-arms has not made wars more bloody—the percentage of total losses in the battles of late wars is rather less than that of former years—but the troops fighting at the decisive points are exposed to very heavy losses in comparitively short spaces of time, and on the enduring qualities of these troops will the result of the battle depend. Now, more than ever before, will the result of a war depend on the quality of troops engaged.

The more murderous the weapons the more disorganizing are their effects and the stricter must be the discipline, in order, with its help, to hurry the masses onward through the terrors of the fight. An iron discipline, therefore, is and will remain the first and most effective means to counteract the effect of the modern weapons.

The best sharpshooter—if not to be unconditionally relied on faithfully to carry out all orders—is worthless compared with a poor shot, but one who offers assurance unhesitatingly to execute all commands.

Not the rifle is the principal weapon, but the individual who uses it.

The physical training of the soldiers should be supplemented by a moral education with the result of infusing into them morality, a high sense of honor, loyalty, and love of flag and country. Only on a ground-work of these virtues can good discipline be built.

II. In his effort to show how and when he would use these

independent patrols, the author considers them in connection with the three arms of the service in the order corresponding to the entry of each into action on the field of battle. First, with the cavalry which is charged with the duty of reconnaissance and that of collecting and transmitting information; then with the artillery, whose task it is to achieve and establish its superiority and shake the hostile troops; and finally, with the infantry, to which falls the work of destroying the tactical units of the opponent.

The main problem assigned to the cavalry must be solved in front of the armies; its divisions must clear the way and its first successes must raise the morale of, and incite to emulation, the troops in rear.

Modern fire-arms have not materially influenced this cavalry duel at the front; rapidity of movement, courage, and enthusiasm are still the deciding factors.

The divisional cavalry has different work to do, upon the performance of which it enters as soon as the veil in front formed by the cavalry divisions is lifted and the armies approach each other for the tremendous conflict.

The general direction and whereabouts of the hostile army have been ascertained by the cavalry division and it remains for the divisional cavalry to make a more minute reconnaissance of the enemy's position and his disposition.

Officers' patrols will first be resorted to for the accomplishment of this object. With fleet horses and powerful field glasses they will be enabled to accomplish much; their reports of the strength and whereabouts of marching columns, camps and bivouac fires, will furnish valuable data for the Commander-in-chief.

These patrols are followed by reconnoitring cavalry. Smokeless powder has made its task much more difficult. To be subjected to fire and probably suffer losses and to remain in ignorance or doubt regarding its source, will result in increased caution and a slower advance. All possible advantage must be taken of cover. Not every bullet, even when propelled by smokeless powder, will strike the mark. Some losses must, however, be expected. But when, with the best will in the world, the cavalry can advance no farther, the infantry must step in and continue the work.

The defender will of course endeavor to frustrate attempts at reconnaissance. The cavalry will be unable to accomplish much, if anything, in front of the position ; its chances may be better on the flanks. At this stage, information regarding the enemy is urgently needed. The cavalry can go no farther and is unsuited to the further work ; smokeless powder has increased the difficulty of observation and the long range of the modern arms the difficulty of approach. To use artillery at this stage, in order to compel the defenders to "show their hands," would weaken the fire power before its effect can be useful to support the attack and would be risky. Nothing remains then to be done but to launch the advance guard into the fight to force the defender to disclose his disposition and intentions. But this is risking a high stake : losses will be sustained to attain a minor object. Once the advance guard has committed itself seriously, the freedom of decision, judgment, and action may be entirely taken out of the hands of the Commander-in-chief.

The artillery must be used to support the troops engaged ; reinforcements may have to be brought up to prevent a repulse ; and, when finally it has been ascertained that the weak point of the defense is at the other wing, it will be impossible to direct and bring the troops there without severe losses. The struggling advance guard cannot be left to itself, and the batteries supporting it can not be spared at the other wing.

Now, at this stage, there is needed a body of troops adapted and competent to carry on the reconnaissance no longer possible to the cavalry, to protect the troops in rear in their advance (advance guard as well as main body) ; a body of troops also possessing the power to force the opponent to disclose his dispositions.

Only selected troops highly intelligent and thoroughly trained and instructed for the work can accomplish such a task. These may be able to collect the required information and afford protection to the artillery in taking position and covering the advance of the masses in rear.

During the raging combat, the cavalry performs its usual work ; it watches the enemy, threatens his flank, and makes report of any suspicious or important movements on his part.

In exceptional cases, it will now, as formerly, be expected to

sacrifice itself to save hard pressed troops from destruction. At the decisive moment there opens before it a splendid field for action. The terrible effect of the new weapons has caused a complete dissolution of the tactical units of the enemy. Just previous to the moment of dissolution, probably all available cartridges have been fired and there can, at that time, be no thought of a fresh supply. Here becomes evident one disadvantage of the rapid-firing arms.

III. Artillery in all phases of the combat, in the attack as well as in the defense, has only one weapon—its gun. Its projectiles are equally damaging to the opponent be he on the offensive or defensive. For it there exists only one method of fighting—the fire from position. The results of improvements in modern guns and the use of smokeless powder have been more serious to the artillery than to the other arms of the service, for it must accommodate its entire tactics to the newly created circumstances.

The object to be fired at cannot be readily observed; over long distances the range can no longer, owing to the smokeless powder, be found, as formerly, by trial shots. The defender's artillery will know the distances to the possible and probable artillery positions of the assailant, his guns will be protected by pits or epaulments, his supply of ammunition will be plentiful and readily available, and the limbers will have been taken to a place of safety. The difficulty encountered by the attacker in placing his artillery, and in finding and overcoming that of the adversary, is apparent. With all the rapidity of action which must be expected of the artillery, it must at the same time act with prudence and circumspection or it will not have a chance to fire a shot. Artillery positions must be reconnoitred with extreme caution; no unnecessary exposure is permitted. The work must be done dismounted and with the aid of good glasses. The batteries then take position under cover, the guns are intrenched, and objectives and ranges determined. But will the artillery have sufficient time to accomplish this? Will it not at once and entirely be launched into the combat? It is true the artillery should enter into action at least as soon as the troops are engaged, in order to assure a preponderance of force. Under present conditions, this "Entering into action" cannot

be accomplished in flying haste, therefore some provision must be made to keep the infantry disengaged till it can be assured of the support of the artillery. The intervening time must be employed in reconnaissance. The latter, if possible, should be made without fighting, in order not to disclose intentions and dispositions made. The troops carrying on this reconnaissance must have power, not only sufficient for their own protection, but also for that of the artillery. Here again is a field for independent patrols. They will either themselves observe the effect of the artillery fire or protect artillerymen sent forward for that purpose. The attacking artillery must try to profit as much by smokeless powder as the artillery of the defense, taking every possible advantage of cover, especially in case of a withdrawal.

It is inadvisable—positively dangerous—to reduce intervals between guns below 20 paces and incur the risk of having more than one gun damaged by the same projectile.

At present, authorities are not agreed whether artillery should be attached to the advance guard or not. This question is really of little or no importance, once we have settled the question how the advance guard should properly be employed. The commander of the advance guard is authorized to seize whatever chances offer themselves by taking a bold initiative. To do this he must have the guns. To take or hold a village or defile, he requires artillery; to check a sudden advance of the enemy, he must have the guns. If, on the contrary, he finds the enemy in position, he must not commit his troops without orders from the Commander-in-chief, whose hand he would otherwise be forcing and whom he would deprive of freedom of action. This would be the natural consequence of engaging either infantry or guns too soon. Independent patrols afford a means of avoiding this.

When the batteries have come into action and the attack and its direction have been decided on, they (the batteries) must silence the opposing batteries and then endeavor to shake his infantry as much as possible.

When the assailants approach closely to the position, the shells should be thrown in rear of the first line of the defender to prevent supports or reserves from being brought up, or at

least to inflict losses on them should they attempt reinforcement.

When the position is carried, fresh batteries of horse artillery should accompany the pursuing cavalry. Each battery will be able to carry, on gun and ammunition wagons, eighteen men of the independent patrols (two patrols, each of 1 N. C. O. and 8 men), who will be of good use as supports to the batteries and in the pursuit. If the retreating enemy halts and checks the cavalry, the batteries and patrols advance.

IV. In considering the subject of independent patrols in connection with the work of infantry, the author treats first of their use on the defensive and next on the offensive.

All the new factors attendant upon the introduction of improved arms and smokeless powder have been more beneficial to the defensive than to the offensive.

Cover now has, primarily, importance and value as a mask. Powder-smoke no longer betrays the firer. This advantage the defender would forego if he failed to profit by natural or provide artificial cover.

The defense may be passive or active. Dismissing the passive defensive with a few words, the author passes to the consideration of the active defensive. As with the offensive, it is here the intention to gain a victory and, if possible, to destroy the enemy. Advantage is taken of strong points offered by the position taken up, the assailant is lured on and made to suffer heavy losses even before offensive returns are made. The defender may be tempted to advance small forces to lead on the attackers. Such practice, with ordinary troops, is to be avoided, for the result is usually a hasty retreat of these advanced troops, having been defeated, closely followed by the assailant. The fire from the position is masked by the defenders own troops and a state of panic usually results.

This is no proof, however, that light troops should not be used to "draw on" or "lead on" the opponent; it is only proof that no tactical units which he can easily crush with superior numbers should be opposed to him.

Patrols trained to independent action in the terrain could, without risk or danger, be sent against the attacker. Behind the screen formed by them a line of guns may be drawn up

while the main body of the force is held in reserve and in position on another front. These patrols, being familiar with the ground passed over in advance, would be able to withdraw quickly at the right moment; no tactical units would be destroyed, no panic would be created by their retreat; but definite information would be obtained regarding the assailants. Consider the case from the point of view of the assailant acting in the ordinary method. His cavalry receives fire from a position to the front and is checked in the advance though the position does not appear to be strongly occupied. The advance guard forms for action and receives artillery fire from two points. Its artillery draws up to reply to this fire. The infantry following receives still heavier fire. Formerly it was possible to tell, from the puffs of smoke, approximately in what strength the infantry were present—a rapid fire from a small number of rifles betrayed itself—now one is no longer able to judge whether the rifles are few or many. Consequently, more deliberation and caution is necessary before deciding on the final attack.

The attack develops, the attackers are only 600 yards from the supposed position and are preparing for the assault, when it is observed that his fire becomes weaker, that his artillery is silent, and that his skirmishers are disappearing.

After a few minutes, the position just abandoned by the defenders is reached and retreating skirmishers are observed about 600 yards to the front, and these at once reopen an effective fire.

In order not to lose advantages just gained, a very cautious movement to the front is demanded. The ground becomes free from obstructions and the hostile skirmishers appear to hasten their retreat. Suddenly artillery projectiles strike in the ranks. Deployment is effected and a rapid advance attempted. The effect of well-directed volleys is now felt, and the assailant realizes that his troops are committed to such an extent that quick action becomes necessary. Under difficulty the artillery gets into position. The troops can no longer be withdrawn without heavy sacrifices, and the assailant decides to push the attack with energy, and to effect this the main body is launched into the fight.

While the attacker is thus suffering heavily in front of the

position, the defender is preparing for an offensive return. His infantry, in position and under cover, can make the very best use of its rifles, having previously ascertained distances, the fire being constantly under control, and the supply of ammunition being plentiful.

In volley firing, the cone of dispersion will not be as great as formerly; the value of a correct estimation of distances has therefore been enhanced.

For instance, a platoon observes at a distance of about 1500 m. a battery taking position. The chief knows that, to be victorious, the duel with the battery must be ended in three minutes or his platoon will be sacrificed. He also knows that he can devote an entire minute to estimating the distance, because, if his estimate is correct, he will be able, in the remaining two minutes, to destroy the battery.

It is impossible to train all men to estimate distances even only fairly well; specially qualified men should be thoroughly trained.

Fire discipline is of greater importance than ever before, and also probably more difficult to preserve in the fight than ever before. In peace training and practice the officers should be very strict and exacting. Volleys only, by groups at least, should be fired to the last possible moment. Doing so will increase the fire effect and tend to preserve discipline. Special men should receive special training in long-distance shooting. It is a waste of time to attempt this with all men.

The importance of the intrenching tool for the defensive is universally acknowledged, but never has its importance appeared greater than at present. Walls and houses, once they are subjected to infantry or artillery fire, are not only useless, but dangerous, as shelter. On the defensive a liberal supply of ammunition is easily provided, and by enforcing good fire discipline it will be husbanded.

Owing to the absence of great clouds of smoke the defender can observe the disposition of the assailant in his necessararily slow advance, and so can take advantage of the most propitious moment for a counter attack.

It is of the greatest importance to the defender to intrench all troops charged with the defense of the position, and also

protect from reverse fire and provide shelter for supports and reserves. It will probably be better to place all troops—those in close order as well as those in extended order—in the first line of intrenchments, in order to have them at hand intact when needed, and not serve as a bullet-stop when being brought up from the rear to reinforce. For cases of emergency intact reserves—consisting of entire companies—must be intrenched and placed to a flank or to the rear. An energetic defense is impossible without an energetic and extensive use of the spade.

The author now considers the use of independent patrols by the assailant, and in doing so distinguishes between the attack on a prepared front and cases where both opponents, being on the march, meet and give battle.

In the latter case, both adversaries, with equal chances, have their troops in column formation on the march. Both will endeavor, by a hasty deployment, to take the initiative.

The advantage will be with him who can first mature a plan and make his dispositions accordingly.

To form a plan for battle, the advance guard being at the time engaged, will be difficult. Artillery—probably also infantry—must be held in readiness to support the advance guard ; to move to either flank would isolate the advance guard. Some of the troops being engaged, the Commander-in-chief is not entirely free to act. Direction may pass entirely out of his hands and the combat assume undreamed of proportions.

If we possess independent patrols to follow—without packs if possible—immediately in rear of the advance guard, cavalry, we would thus have a buffer, enabling us to observe the principle of keeping masses well to the rear.

In order to more clearly show the value and use of such independent patrols the development of such an engagement is followed.

Two hostile divisions, of equal strength, are marching towards each other. Their officers' patrols at the front have come in touch. The chances are equal.

The cavalry on both sides begins its work, but without any effect for either side, and the chances are still equal.

While the cavalry is engaged, the independent patrols—far

ahead of the advance guard—approach. All the independent patrols of the advance guard (the latter three battalions strong) have been united and are commanded by a mounted officer. These patrols, numbering 324 rifles, are brought into action against the hostile cavalry and force it back.

The mounted officer quickly selects a line to be occupied by his patrols. The cavalry patrols report to the Commander-in-chief that the advance guard of the opponent is deploying while his columns have been halted in rear. This important information shows that the enemy imagines he has to deal with a small force only which he expects easily to brush aside, in order to continue his march. Knowing this, a plan for battle can be decided on. By the aid of the map, the commander, for instance, decides to deploy his advance guard behind the elevation, X, to move the main body to a flank, Y, change front and there form for action and advance as soon as the enemy is seriously engaged with the advance guard and when he brings his main body up for support.

The chances are already in our favor.

The temporizing conduct of the independent patrols is here conducted the same as when acting on the defensive, as shown before.

As soon as the enemy attacks seriously and in force, they fall back to the advance guard.

The adversary follows with his advance guard deployed, his main body still in the march formation.

On our side, the main body continues to execute its change of front.

Now the advance guards are engaged. The opponent considers seriously which wing to attack. Having finally decided, he orders up the main body and brings all the latter's artillery to bear.

Our main body has changed front, deployed, and begun the forward movement; and the position of the opponent is by no means an enviable one. His advance guard is severely pressed and his artillery busily engaged. Suddenly he is attacked in flank and forced to change front. The initiative is lost to him.

With us things are more favorable. Our advance guard, reinforced by artiltery, keeps considerable forces of the enemy,

especially his artillery, successfully occupied. Our main body is deployed and enters simultaneously into action. We force our will on the opponent and secure the moral advantage of the tactical offensive opposed to an adversary who cannot retreat into a strong defensive position, but who must take the ground as he finds it and who can use his troops only as they successively arrive.

For the advantages secured, we are indebted to the independent patrols.

In the attack on positions, we must bear in mind that, in most cases, the terrain is not very favorable; that losses sustained in the advance are very considerable, and that the supply of ammunition is doubtful; while the opponent has taken all possible advantage of the ground, constructed artificial cover, is in position in tactical units, and has a well-regulated supply of ammunition. From this can be seen that an attack on a fortified position has chances of success only under certain conditions.

To force an enemy to leave a position we can either attack him and drive him out of it or we can manœuvre him out of it.

With the former alternative, if successful, a victory is gained and the adversary is made to suffer losses; while the latter has the advantage of having forced, without any loss to ourselves, the opponent to execute a retrograde movement with probable result that the chances of a victory in a following decisive engagement are in our favor.

The choice of the two methods would be dependent mainly on the relative strength of the forces opposed to each other and the configuration of the ground.

The strength of the opposing forces being only very indefinitely known to each adversary, detached divisions and brigades will only in very exceptional cases attempt an attack on a fortified position. The stronger the army of the assailant, the better is he in condition to obtain at some point of the hostile position a tactical superiority.

Attacks over clear and shelterless ground on an intrenched and unshaken enemy—like that of St. Privât—must be regarded as impossible of success and must be avoided.

The ultimate object of all operations is the destruction of the opponent's forces. To do this we must engage him in bat-

tle. To give battle is therefore the object of our movements. The battle throws the best chances of success to him who can make the best use of the modern murderous weapons. We must strive therefore to shape circumstances so that we either can make the best and fullest use of our weapons, or prevent the enemy from doing so.

It is an old maxim of the art of war, that one must try to force one's will on the adversary. It would be violating this principle should we attack every position selected and occupied by the enemy (unless the chances of success are clearly in our favor), for then we should do his will.

Finding the enemy in position and ready to accept battle, we must carefully weigh the chances for success in our favor. Should the terrain be favorable for the attack and unfavorable for the defense, the attack may be risked, otherwise resort had better be had to the method of manœuvring the opponent out of position.

By manœuvring, we mean movements of large bodies of troops in the vicinity of the enemy.

It sounds easy but is, nevertheless, very difficult to move a division at war strength from one place to another.

If this movement is not made on level and unobstructed ground and in sunshine, much training of troops and leaders is necessary to insure its success. Should the terrain be obstructed and difficult, should it rain, or night come on, or should the possibility exist of an attack by the enemy, which would necessitate a deployment to the front or flanks at any moment, it is readily seen what an amount of peace training and practice will be necessary to work without friction in war time.

From this will be seen the importance of precise close order drills even of larger bodies of troops. The present time, unfortunately, leans much towards the theory that, as column formations are no longer used in the combat, the importance of close order drills has vastly decreased. In opposition to this we must emphasize: We need the close order drills less *in* the battle than in movements *to* the battle. Only to certain points will our masses be directed in the future to the attack. But to these points our masses must move quickly and orderly, even under severe difficulties.

Such movements will often have to be made at dark, and to be certain of success then pre-supposes absolute certainty and familiarity in the execution of the movement in day time even under difficulties.

It is a law about which doubt is not permissible, that an assault by infantry must never be undertaken unless our artillery has—at the point of attack—entirely silenced and disabled that of the defender and has also shaken his infantry.

HOW SHALL WE, IN THE FUTURE, ATTACK PREPARED DEFENSIVE POSITIONS?

This sentence, without doubt, contains the most important of all tactical questions, forced on us for consideration by the introduction of modern arms.

Upon a change in the methods or means employed by the defense, owing to the new weapons, must be consequent a change in the form of attack.

It remains now to be shown what means and forms formerly employed are no longer adequate and must be discarded and what must be substituted in their place.

Now the author follows a modern attack from beginning to end, and I will give his account in his own words as nearly as possible.

First Stage.—The cavalry division at the front reports to the corps commander, who follows with the corps probably a day's march in rear: "The enemy is in position between A and B. His wings have been ascertained to be at A and B. Our mounted men have received fire from the wood at C, from the villages at D and E, and from the farther shore of the creek F," etc., etc.

Second Stage.—The Commander-in-chief, having as far as possible studied the terrain over which he must advance, must, by the aid of his map, judge of the situation in general, of the intentions of the adversary, the advantages and disadvantages of his position and of his approximate strength. He must decide whether to advance straight to the front to give battle or to attempt to manœuvre the enemy out of his position.

In the latter case he gives the necessary orders now; in the former, the march to the front is continued to within about 4000 m. of the position.

Third Stage.—More than ever is great care required in this work. Puffs of smoke no longer betray the enemy. The defender will have taken every possible advantage of cover (natural and artificial) to mislead the assailant and to induce him to make faulty dispositions.

The cavalry of the advance guard has halted about 2500 m. from the position. Cavalry patrols at from 1500 to 1000 m. of the position have been prevented from a further advance by volley fire from the position.

The Commander-in-chief is satisfied that the cavalry is unable to proceed further or procure the information required and which alone will warrant an advance and an engagement.

Infantry troops must take the place of the cavalry.

According to the present current idea, the correct action of the Commander-in-chief would be to deploy individual platoons and companies to draw the enemy's fire (and thereby learn his disposition) opposite all the points of the position which seem to require attention.

Are these units on a war footing suited for the purpose? The whole company will probably have only one old officer from the standing army—the reserve officers and men will be unsuited for it. These troops can not advance 2000 m. in deployed formation. They will sustain serious losses between 2000 and 1000 m., which will, in their effect, be doubly demoralizing, being inflicted by an invisible foe. With the remainder, even should they advance to within 600 m., nothing can be done. They will lie down, waste their ammunition, and long for reinforcements.

Here is a field for the work of specially trained independent patrols, who combine exceptional skill and courage and who can take the place of the tactical units. The Commander-in-chief disposes of all such patrols of the advance guard, assigning to the patrols of each battalion or regiment such terrain reconnaissance as he considers necessary.

These patrols, without pack, if possible, and carrying reserve ammunition in their haversacks, having received their instructions, will begin a very cautious advance. The leader of each patrol in advance, the others following singly, they move, creep or run from cover to cover. If the enemy opens on them

with volleys between 2000 and 1000 m. from the position, the losses will be only trifling. They will be able to get within effective range and make their fire tell. Their position must not be considered unduly critical or dangerous, for the defender has obstructed his front with obstacles and so himself has abandoned much freedom of motion, and he will not leave his trenches to attack them, and, if cavalry is sent against them, they will know how to defend themselves.

Under the protection of these patrols, staff officers and officers of the cavalry, provided with good field glasses, will make their reconnaissance, taking advantage of good points of observation, while officers' patrols attempt to penetrate around the flanks and rear of the enemy.

Fourth Stage.—From the information collected, the Commander-in-chief decides on the point and direction of attack which promises a superiority of fire and fulfills the following conditions as nearly as possible :

1st. Good artillery position, allowing such a number of batteries to be placed that a superiority of fire and consequent destruction of the hostile batteries, opposed at that point, may confidently be expected.

2d. Lines of approach for infantry to position, at least partly protected from the enemy's fire and concealed from his sight.

3d. Neither the artillery nor the attacking infantry will be exposed to concentric fire, on the contrary, everything favors bringing a convergent fire against the enemy. The flanks will undoubtedly fulfill these requirements more readily than any other part of the position.

Fifth Stage.—The Commander-in-chief makes the following dispositions for attack :

a. All the artillery of the corps takes position in the line M-N, and directs its fire on the hostile position between F and G on which the infantry attack will be made ; the commander of the artillery will give further orders required and will also direct changes of position when necessary.

b. The main body deploys, concealed as much as possible from sight of the enemy, 3000 or 4000 m. in front of the position ; a reserve is designated for the Commander-in-chief ; the

amount of ammunition carried is increased by filling the haversacks; packs are taken off.

c. The independent patrols of the advance guard, engaged along the front of the attack, are reinforced by the independent patrols of the main body. The patrols move cautiously to the front.

Sixth Stage.—The attack begins. The batteries open fire and the artillery duel is prosecuted with the greatest energy. Too much importance can not be attached to this phase of the combat; if the assailant fails to establish his superiority, his infantry has no hope of success.

Owing to a lack of time during manœuvres, a fair representation of this part of the action is impossible; but we must remember that this short preparation of the infantry attack as practiced at the manœuvres is only a peace condition. Infantry officers cannot realize too soon that with an approximate equality of forces, success can only be hoped for when the artillery has been able to do its share of the work.

Owing to this increased importance of the artillery, the greatest watchfulness should be devoted to its training. In no other arm do faults in the instruction entail such consequences as quickly, as certainly and as terrible. Besides requiring the greatest mechanical perfection, the greatest requirements must be made on leaders and on their training. Artillery should undergo little or no change on mobilization. Batteries formed only at the outbreak of a war prove often only more or less of a burden.

The Commander-in-chief, in order to profit as much as possible from the fire of the artillery, must not hasten his work, but must quietly await the report of the commander of the artillery that the opposing batteries have been silenced and that the fire has been directed on his infantry.

In the meantime the assailant's infantry forms for the attack. The first line consists of a dense chain of skirmishers, followed in second line by the troops destined to assault. In rear of this is a special reserve at the disposal of the Commander-in-chief, to which reserve several horse batteries have been attached. These batteries are taken from the cavalry division, for all foot batteries are engaged. The cavalry division prepares for the pursuit of the enemy. If it has become necessary

the independent patrols at the front have been reinforced by the independent patrols of the other battalions.

Seventh Stage.—While the artillery continues to direct an effective fire against the defender's infantry position and also on the space in rear of it, the Commander-in-chief gives the signal for the infantry attack to begin.

The first line—a dense chain of skirmishers—begins its movement to the front. At 2000 m. in front of the position it receives infantry fire. Without replying to it the advance is continued, if possible, to within 600 m. of the position, that is, up to where the independent patrols are.

The defenders, knowing distances almost accurately to objects within 2000 m., with a plentiful supply of ammunition, unobstructed vision, owing to absence of powder smoke, will be able to direct a very effective fire, especially by volleys, on the attackers. This fire will be the more demoralizing on account of uncertainty as to its origin, and the inability to return it. Against an unshaken defender, firing calmly and deliberately, the attackers will sustain the heaviest losses between 2000 and 1000 m. from the position. These losses will be so great that the remnant who succeed in crossing this zone will hardly possess the moral power to overwhelm with their fire the still unshaken enemy.

To protect the skirmish line from such a fate, there is only one means, and that is, to shake and demoralize the defenders previous to the attack of the infantry.

This object is attained by making every possible use of the artillery after it has silenced the opposing batteries, and also of the fire of the independent patrols. Let us put ourselves in the defender's place. For several hours his infantry, at a high pitch of expectation and anxiety as to what is to come, has been lying in the trenches. Only weak bodies of cavalry and, later, patrols have shown themselves; fire opened on them was soon discontinued on account of its apparent non-effect over the great distances and against comparatively small objectives. The artillery duel, which they were forced to witness next, did not tend to raise their spirits or morale. As their own artillery became weaker and weaker, they concluded instinctively that the opponent was superior. Then suddenly the intensity of the enemy's

fire increases beyond anything experienced before, and his entire force of artillery throws shells among the infantry which believed itself protected. The noise of the bursting shells, together with their destructive effect, rapidly produce most disastrous effects on the nerves of the defenders. In vain are attempts to reinforce the shaken and much diminished first line. The entire ground behind the position is so swept by the fire of the hostile guns, that only the débris of partially successful efforts at reinforcing ever reach the trenches.

At this moment there appears, 2000 m. in front of the position, a rapidly advancing line of skirmishers. The few leaders not dead or wounded succeed in drawing the attention of the half demoralized masses to this new danger, and a fire, not distinguished for precision of aim and accuracy, is directed against the line. At this moment the enemy's artillery fire becomes more murderous than ever; the hostile patrols, at a distance of 600 m., open an effective rapid fire on them, and to continue to remain in this shower of projectiles, this hell of fire, becomes an impossibility.

If our artillery fails to silence the defender's guns and direct its attention to the infantry, if we have not the chain of fire, formed by the independent patrols, in our front, the losses sustained in reaching the first firing station at 600 m. from the position will be so great that we cannot hope for success.

The skirmish line reaches the independent patrols and greatly augments their fire. In order to reinforce the first line and fill up space due to losses sustained in the advance, the Commander-in-chief can direct a second skirmish line to follow the first at a distance of 1000 m. This line comes up with the first where the latter has halted abreast of the independent patrols, and, by its impetus, carries the whole farther to the front. At 1000 m. in rear, the assaulting line follows, with bayonets fixed,—meant as a visible sign to the men themselves what is expected of them. With drums beating, colors flying, bands playing inspiring national war songs, the regiments advance as in review, animated with one sentiment only: "to conquer or die."

While the assaulting line comes closer, the skirmish line

advances to the principal and final fire station, which is about 400 m. from the position. With the present rifle, it would be a loss of time and men to attempt an advance to 200 m. from the position for the final fire halt, when as much can be accomplished at 400 m. Here the final decision is brought on by an overwhelming mass fire, and the last resistance of the defender is broken by the time the assaulting line has come up.

As soon as our artillery fire is masked by our own troops, the guns must be directed on any hostile reserves which may appear. They must by no means diminish their fire, but should, if possible, increase it.

One thousand m. in rear of the assaulting line follows the special reserve of the Commander-in-chief, and behind it the cavalry, ready for the pursuit of the defeated enemy.

Eighth Stage.—As soon as the firing line has been joined by the assaulting line, the advance to the assault begins. It may be advisable in the future to form company columns (company in column of platoons) in the assaulting line, in order to increase the power of shock, and also in order to absorb the firing line in the intervals between the companies.

The nearer we approach the position, the faster becomes the cadence of the step, till finally, with beating of drums and blowing of trumpets, the position is carried.

It must be remembered that it is easier to destroy the enemy by fire effect from the last fire station than with the bayonet in the position, and therefore the final assault must not be ordered one minute too soon.

Ninth Stage.—The last part of the attack—the pursuit—begins as soon as the position is reached and the enemy shows his back. The word "pursuit" will have an electrifying effect on all the troops.

The firing and assaulting lines halt and direct a mass fire after the enemy.

The special reserve hastens its advance; being composed of tactical units, it takes up the pursuit at once.

The cavalry starts after the enemy and is accompanied by horse artillery, who carry on their limbers and caissons the independent patrols of the special reserve.

The ammunition columns come up.

As soon as the infantry enters into the hostile position, such batteries as are able, will, at the fastest possible gait, also advance to the position and form there and continue their fire on the enemy.

When the pursuing fire of the artillery is of no further effect on the retreating enemy, the independent patrols of the former assaulting line advance in a broad front. Behind them rallies in first line the former assaulting line, and in second line the former firing line; all replenish their ammunition as soon as the ammunition wagons arrive.

In the meantime the cavalry has advanced, passing by our flank, and the special reserve follows as the advance guard of the line of independent patrols in its rear.

Circumstances must decide as to the further use to be made of the masses.

We should remember after every victory, the two classic orders for pursuit recorded in our military history.

The day of Waterloo closed with the order: "Pursuit to the last breath of horse and man"; the day of St. Quentin with the order: "Every command will march 5 miles to morrow." (A German mile equals 8238 yards and 5 German miles equal therefore about 23½ of our miles.)

The Campaign of 1870–71, in spite of above order, furnishes no illustration of effective pursuit; the cause assigned for this is, that the fights were always so sharp and stubborn that all tactical units were broken and intermingled and there were no fresh troops at hand at the moment for the pursuit. The existing circumstances often forbade a pursuit. All this will obtain in the next campaign and to a greater degree, and still we must find means to make pursuit possible.

It is hoped that in the independent patrols we have found the means of doing so.

They can and will follow, and will accomplish more than tactical units, owing to their greater mobility; they also possess sufficient fire power for the purpose. Behind them, quickly rallied bodies of troops can follow.

We must remember that a successful pursuit is a second victory, and a complete rout and destruction of the enemy is in most cases accomplished by a successful pursuit.

We do not claim to have given, in the foregoing, a recipe for a normal attack ; on the contrary, we know that no two attacks can be alike, for the relative proportion of numbers, the terrain, and the moral factors are never the same. It was only to show, by an example, what points must now be especially considered by the Commander-in-chief, owing to the different effect produced by the new weapons.

If, after mature consideration, the Commander-in-chief thinks the chances of success do not warrant an attack, another possibility is at his disposal. With his independent patrols he can keep the enemy's front occupied during the day, so ascertaining the weak points of the position, and at such a weak point assemble his forces at dark and prepare for a surprise attack.

Night movements of large bodies of troops, the author expects to be very numerous in the future. They are of the class of means by the adoption of which we preserve the idea of the attack, but greatly save ourselves from the destructive fire directed on the glacis of the position. Only well disciplined and trained troops can execute night movements with precision and certainty. The training includes a systematic preparation. The beginning is made with the company, on broad roads, where the men are taught that order and the correct formation can be maintained in the dark. Turning off into a more narrow road, column of twos and files is formed and, later again, column of fours. Arrived at a free space, company column (x) is formed and the company is practiced in marching to the front, changing direction, etc. Finally, advancing on designated objects is practiced and, during this advance, the independent patrols move as skirmishers in front (probably ten paces) of the column and on its flanks.

Later, chiefs of platoons are required to march at night on points designated to them on the map. At first, such points will be selected which are near roads ; later, such to which no roads lead. At first plenty of time, later less time, is allowed to accomplish the task ; at first open, and later difficult and close terrain, is selected. The platoon remains at all times in close order ; its independent patrol moves in its front. The battalion receives its training in the same spirit. On very dark nights, independent patrols are employed to preserve connection between

the columns. Regiments and brigades should also receive instruction in night marches and during the manœuvres it will not be difficult to find an opportunity for executing a night march by division or corps, to be followed at daybreak by an attack.

Night attacks have also materially gained in importance, especially in the minor operations of war where the conditions of a surprise are often very favorable. Here the independent patrols will be of particular value, for by their use we will be enabled to keep platoons or companies in close order.

The author recommends to all leaders a thorough study of the subject of night attacks in field and fortress warfare. What an important part the independent patrols can be made to play in these night operations, can be readily seen. (x column of platoons.)

V. Proposed organization and training of these independent patrols.

The increased effect of modern weapons demands an increased training of the troops for their work. Not every soldier possesses equal qualifications for every branch of the service, nor for all the work in any one branch. To take advantage of this qualification for special work a class of specialists should be educated.

We have already shown the importance of a correct estimation of distances; only specially adapted and qualified men will in this line attain to the requirements of the present time.

It is similar with the patrols. To use them as shown in the foregoing pages to be necessary, the more intelligent men must have a most careful training; they must be educated specialists in the full sense of the word.

Regarding numbers, it will be sufficient if each company has three such patrols, one to each platoon.

Their strength, in time of peace, could be a leader and four men, in time of war, a leader and eight men.

For leaders will, of course, be selected the sharpest, cleverest, most active and adroit men, physically perfect.

The patrols will, except when forming for parade or drill, form under their leaders on the left of the company. In column of march, they are ordinarily in rear of their respective platoons.

It is optional, however, with the company commander, to place them at the head of the column.

The men selected to form the independent patrols must be ambitious and possess especial military talent. They may under certain circumstances be the greatest scamps in the company; men who value their own lives for nothing when something exceptional is demanded; men who may be careless but not bad or depraved.

The training is both theoretical and practical. For theoretical and part of the practical instruction of the independent patrols of a battalion, a reliable, specially qualified, older officer is selected and trusted with this important work. For a certain time in the year, the patrols of the battalion are placed entirely at the disposal of this officer. He will proceed with their instruction according to a well-matured plan. The patrols will be taught how to acquire a knowledge of terrain; how to use the terrain when desiring to see and observe and how to use it when desiring not to be seen; how positions, bodies of troops, at a halt or on the march, are observed and reconnoitred; how in woods or at night to orient themselves; how to draw or lead on detachments of the enemy; how to reconnoitre in the dark, etc., etc.

In the practical as well as theoretical instruction, their attention will be called to the fact, that thunder storms, rain, snow, and fog are favorable for an advance, as they act as a sort of screen; that wet weather is unfavorable, the patrols having to move across country, the roads being probably under control of the enemy.

They will carry on their practices against an outlined enemy, or two neighboring garrisons will combine in the practice, the independent patrols of battalions, regiments or posts being united.

The leaders and men of these patrols are to be appointed "Patrouilleurs" by company order (such a position being especially created for this purpose) and are to wear an appropriate insignia.

Ordinarily, in action, an officer would be assigned to command the patrols, except when the patrols of a larger body (battalion or regiment) are united for a special mission. Even then

he must not handicap the independence of the patrols. He should simply regulate the advance and the hour for return and, for this purpose, agree upon some signs with the patrol leaders.

Patrols may, if advisable, remain detached from their companies one or two days; they must therefore be taught how to provide for the safety of their camp at night.

Every leader should be provided with a good field glass.

The author now asks not to condemn his plan hastily without mature consideration. Certainly, he continues, there will be many cases in war where these patrols cannot be used,—there will probably be other cases where they can be dispensed with, but this is certain: No injury is worked by the creation of these intelligent independent patrols. We raise a part of the men above their less talented comrades, we create in our companies a nucleus of reliable and ambitious soldiers, ever ready to act with prudence, to do patrolling, carry reports and messages; men whose sense of duty is highly developed and upon whose faithfulness the company commander may rely. These results alone should prove sufficiently tempting to carry this scheme into practice.

But in battle,—with smokeless powder and the enormous effect of the new weapons—where masses must be held at the rear, we cannot dispense with this numerically weak but highly intelligent body of troops for purposes of reconnaissance to the front and protection of troops in rear.

The main difference between these independent patrols and the regular patrols now in use is that the latter are only "to see," whereas the former are "to see" and "to fight" also.

Finally, the author is convinced that the next war will create in all armies, either in the form suggested or one similar to it, such an intelligent and extremely mobile body of troops.

While undoubtedly there are some who do not agree with the author on some points touched in his article, still the truth and force of the argument in favor of the creation of independent patrols must be admitted. Many who have read the pamphlet, may claim that the author makes too sure of the invisibility of the new powder and the absence of the flash consequent upon the discharge of the arm. Granting this to be so,

though it is by no means proved, especially when we consider the long distance at which firing takes place with the new arms, and which distances the author may be credited with having had in view, the strength of the argument nevertheless remains.

It may at first glance appear to be a herculean task to overcome the difficulty of securing coöperation between the different groups. But difficult tasks have been accomplished before, and the particular organization proposed by the author for these patrols need not be adopted, provided the purpose for which their creation is urged, is accomplished. General Von der Goltz is not an extremist either of the close order school or of the extended order school. He is considered a moderate in this respect, and the treatment by him of the subject of "Independent Patrols" is conspicuous by the absence of extreme views and suggestions. Admitting the correctness of the views entertained by General Von der Goltz regarding the necessity of this buffer in front of the skirmish line, of numerically weak but highly intelligent forces, it remains to be determined how such forces are best organized by each state or nation.

In the solution of this question consideration must be had of the national characteristics of a people and its government and to the spirit of its institutions. What is possible of accomplishment in a matter of this kind in Germany ("The Nation in Arms") with its compulsory military service, and the many advantages it possesses from a military point of view, is probably utterly impossible with us.

The importance of a thorough reconnaissance of the ground to be passed over has been repeatedly shown during the Franco-German War of 1870–71. At the battle of Wörth, Aug. 6, 1870, the right wing of the French was sorely pressed by the Germans. To relieve it, Major-General Lartigue, who commanded this wing, ordered one regiment of Michel's brigade of cuirassiers, which was then in rear of the wing, to take the attackers in flank. Instead of one regiment being sent, the entire brigade (2 regiments) and a part of the 6th Regiment of lancers was set in motion. The ground over which this cavalry had to pass was full of obstacles and extremely unfavorable for the attackers but very favorable for the German infantry against which the attack was directed. This had not been ascertained before

the movement was begun and the melancholy result was the total destruction of those splendid regiments. That the Germans have sustained heavy losses in this same campaign, owing to neglects of similar character, is generally brought to light by the writings of officers who participated in the fights, such as Major Fritz Hoenig, Meckel, and others. Twenty-five years have elapsed since then and the truth is becoming known only now, which tends to prove that Wellington was not far wrong when he said "At the close of every great campaign, truth lies at the bottom of a very deep well, and it takes twenty years to get her out of it."

The following special instructions concerning the selection and instruction of the French "Eclaireurs" (scouts) is to be found at par. 126 *et sequitur* in Part III. "Regulations for Drill and Manœuvres of the French Infantry, School of the Company, Ministerial Decision of April 15, 1894." "Smokeless powder, the precision of armaments, the flatness of the trajectory, and the rapidity of fire have made a sheltered adversary more invisible and have increased the danger zone.

"These result in making the reconnaissance of an enemy's position extremely difficult for mounted men; only well instructed infantry scouts, who profit by the smallest accidents of the ground, can crawl up sufficiently close to an enemy's position to obtain reliable information and to avoid surprises. It thus becomes necessary for every body of infantry troops to have scouts. The instructions which follow, herewith, are given for the purpose of organizing that service and to indicate its functions on general lines.

"In each company, two men in each squad are to be especially selected and instructed for duty as scouts.* As far as practicable only one will be used, holding the other as a substitute. They must have excellent eye-sight, be intelligent, active, good shots, good marchers, and generally well set up.

"The battalion commander or the captain of a separate company decides whether they (the scouts) shall be employed. He selects the officer or non-commissioned officer who shall take charge of them. As a rule, they cover the front of their com-

* On a peace basis a company has eight squads; on a war basis, 16; therefore they have either 16 or 32 scouts.

panies and fight with them. Only exceptionally are they to be united by battalion for special work.

"The distances at which they are sent out to cover the troops varies essentially; much depends upon the enemy to be engaged and the nature of the mission confided to them, as well as any eventuality or character of the ground.

"They are always to remain, by every possible means, in communication with their companies, using, if necessary, extra men to transmit their messages, which men the captain detaches successively.

"The scouts belonging to two adjoining companies are bound to render mutual support. In the field they are economized as much as possible.

"An officer, with a sergeant and two selected corporals as assistants, frequently assembles the company scouts in time of peace to complete their special instruction. He goes over the general instructions given to all men of the company, such as working over ground, searching woods, villages, etc. He makes them estimate distances and the strength of bodies of troops seen afar off; he then drills them in their specialties for battle, to move within a fixed zone and to avail themselves of the most favorable conditions toward a figurative enemy, reconnoitring his defenses; finally, he teaches them how to transmit the information they have secured. These drills should be held on a variety of grounds. The battalion commander gives special attention to this part of the instruction.

"The battle front of a company depends upon its effective strength and its tactical position. A company containing 200 rifles occupies in line a front of about 150 metres.

"They furnish information of practicable routes, favorable points for stopping places, and drive back the enemy's scouts; in sheltered or broken ground, they move out to the points designated by the captain. If this position cannot be determined, the scouts are halted far enough away from the enemy's infantry so that they may not be compromised and that their company may readily come up to them; but they must still move out far enough to be able to develop the enemy's artillery and infantry positions and bother their fire.

"They then select a good position, and there await the com-

ing of their company, and by their fire seek to assist it to come on the line; a few men are detached, if necessary, to complete the reconnaissance of the enemy's position. Their chief collects the information gained, including that which concerns artillery ranges, compiles and transmits it. The captain places himself in communication with him.

"The duties of the scouts end as soon as their companies overtake them. They are rated on their personal descriptive books as designated scouts."

The French scouts, though similarly organized and trained, are of course distinctly different from the "Independent Patrols" recommended by Von der Goltz. This authority plainly states that the "Independent Patrols" are necessary in addition to the scouts and patrols already in use in connection with their companies.

The great utility of trained scouts in infantry companies is evident and, in this particular, it would probably be well for us to pattern after the French. The extract of the French regulations bearing on this subject and cited above, provides for the organization, training, and use on the battle-field, of these scouts and probably only unimportant changes would be found necessary if such a regulation were inserted in our drill regulations.

The scheme of organization of these scouts, as set forth in the extract referred to before, is apparently so feasible that, with the excellent material at our disposal for such purpose, should we introduce this element in our companies, it would tend to increase their efficiency in a great measure.

In paragraphs 582, 583, 585 and 586 of our Infantry Drill Regulations, mention is made of the use of scouts in action, but in this field as in any other, specially qualified men must receive special training in order to obtain best results, and to this end organization and method of instruction are indispensable.

Regarding "Independent Patrols," once having realized their necessity, to decide upon suitable organization should not be difficult. The Independent Patrols are meant undoubtedly to fulfill a relatively similar rôle as formerly did the light infantry of Frederick the Great and of the Peninsular War. Their organization, however, is different.

Our companies are too small to admit of further depletion

consequent upon the adoption of the organization proposed by the author of "Independent Patrols." With us it would be far better to create companies of light infantry—one to each regiment—composed of such material as General Von der Goltz wants for his "Independent Patrols."

More unity of action would be secured with a company organization and the training of the men would be greatly facilitated. A field of great possibilities is open for such light troops.

The Commanding General of the Army, General Nelson A. Miles, says in his Annual Report of 1895:

"A very great progress is being made in European countries, in the use of the bicycle and motor wagon, and as both have been found practicable in this country, and would certainly be utilized to a great extent in case of war, I recommend that a force equal to one full regiment of twelve companies be equipped with bicycles and motor wagons, and their utility thoroughly demonstrated by actual service. There are more than 4000 officers and men in the army who are able to use the bicycle as a means of transportation. The officers and men for such a regiment to be so equipped, should be carefully selected from the most efficient and skilfull in the use of this modern appliance and I recommend that authority for such transfer be granted with as little delay as practicable.

"The bicycle has been found exceedingly useful in reconnoitring different sections of the country."

Companies of light infantry composed of highly intelligent men trained for their work, and skilled in the use of the bicycle as a means of transportation, having motor wagons attached for the purpose of carrying reserve ammunition, subsistence, etc., would greatly augment the efficiency of our infantry.

These companies should serve at regimental headquarters and their strength should be:

One captain, 1 1st lieutenant, 1 2d lieutenant, 1 first sergeant, 7 sergeants, 7 corporals and 50 privates; 65 enlisted men in all.

It is not the purpose of this paper to enter more fully into the details of organization and training of such light troops than has already been done, especially in the work of General

Von der Goltz, nor to dwell on the question as to the pattern of bicycle or motor wagon best suited for their equipment.

That we have the best material in the world for the creation of such light infantry companies, mounted on bicycles and accompanied by motor wagons, no one, who will give the matter any serious consideration, can doubt for a moment.

PREVENTABLE DISEASES.*

By Captain and Asst. Surgeon H. S. T. HARRIS, U. S. Army.

IF any reader of this paper expects that I shall lay down a special course of treatment which will render the body invulnerable to any or all of the diseases which "flesh is heir to," he is doomed to disappointment. Fresh air, pure water, wholesome food, personal cleanliness, and plenty of exercise constitute our armor against disease.

I lay no claim to originality in any of the views set forth in this article, as it is merely a compend of a few facts gleaned from a course of reading in Notter and Firth's "Hygiene," with occasional references to my own limited experience. It is simply a note of warning as to some of the dangers which assail us in our daily lives through water, air, soil and food, with a mention of the manner in which some of the principal infectious diseases are propagated and of the means by which they may best be avoided.

The necessity of a pure and wholesome water supply is too evident to require comment. It should be a matter of constant care in every post that it should be delivered to the members of the garrison uncontaminated. The specific germs of cholera and typhoid fever are usually introduced by means of drinking water which has become infected by leakage or seepage from

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water closets. If the bacilli of these graver diseases are absent, a water thus impure may produce diarrhœa or dysentery. Diarrhœa is also produced by a water containing a large amount of certain mineral salts in solution, notably the sulphates; while a water full of decomposing vegetable matter is a potent aid to bad air in the production of malaria.

Accordingly, you should not locate your well or cistern in one corner of your yard and the pit for your privy in the other; you should not allow laundress's quarters to be built on the banks of the stream which furnishes your water supply, above the place from which it is pumped; and the same remark applies to graveyards, Indian tepees, and stables. If you do not object to dirty soapsuds, spoiled food, stale urine, fæcal contamination, nitrates and ammonia from dead bodies, on æsthetic grounds, you should shun them from fear of diarrhœa, dysentery, typhoid fever and cholera.

Much of the water in our western country is strongly alkaline and produces diarrhœa. Boiling precipitates a portion of this alkali and still more of it is rendered harmless when coffee is drunk instead of water.

A water may appear clear and sparkling which has flowed through marshes, or over miles of fallen decaying leaves, and has thus become impregnated with the poison of malaria. As pointed out by Dr. Smart, many apparently fine mountain waters are often thus polluted.

When I was at Fort Ringgold, Texas, for a short time in the spring of 1886, there were six cases of Rio Grande fever in the hospital. At that time the Rio Grande water was drunk after being merely settled for a few hours in a tank. When I returned to the same post in the spring of '87, the post surgeon, Dr. W. T. Carter, had introduced the use of distilled water, and in that year there was only one case of the fever, in the person of the doctor himself. He fell a victim, I think, to his devotion to sanitary science, as he spent most of his time trying to ferret out all the insanitary conditions about the post. By the change in drinking water the total sick-rate of the post was reduced 50 per cent., as shown by a comparison of the hospital reports for 1886 and 1887.

An outbreak of diarrhœa and dysentery at Fort Davis,

Texas, some years ago, led to the discovery that the settling tank was melodious with bull frogs and alive with tadpoles.

I notice two instances of the grave effects of the consumption of impure water in the press of the day. A close investigation of some sixty cases of typhoid fever occurring in Paterson, New Jersey, showed that the affected families all obtained their milk from the same dairy. Inspection of this dairy showed that the owner had three sons ill with typhoid fever, and that the sewage of the place was discharged into a stream near by, by means of a pipe which was located a short distance *above* another pipe through which water was pumped from the stream for washing the milk cans and for general use about the dairy.

Dr. E. D. Bondurant, of Tuscaloosa, Alabama, reports two outbreaks of a rare oriental disease known as beri-beri in the Bryce Insane Asylum, at Tuscaloosa. Up to 1895 the asylum had used the water from a spring near the institution, but the increase of the number of inmates had caused this supply to become insufficient, and a tank had been built, which was filled when necessary from the Warrior River by the water company supplying the town of Tuscaloosa.

The sewage from the asylum flows into the Warrior River below the pump of the water company; but a short time before, a dam thirty feet high had been built still farther down the river. This dam backed up the water upon the banks and into the sloughs and tributaries; stopped the current and caused the water to become distinctly offensive. That it did become offensive, is not surprising when you consider that it was contaminated by the decaying vegetation which had been killed by the rise, and by the sewage, solid and liquid, of over twelve hundred people.

Every time the supply from the spring proved insufficient at the asylum, the tank was filled and the water from it used. This happened some three times in eighteen months and on each occasion the use of this impure water was followed by an outbreak of beri-beri with other cases of dysentery, diarrhœa and malarial fever.

As to the purification of water: The source from which it is derived should be carefully inspected, and rendered sanitary

as far as possible. Storage tanks should be cleaned frequently, and unless built of iron, should always be located above ground to prevent seepage into them.

Where a system of sewerage exists, it should be seen that it is absolutely disconnected from the water supply and that there is no possibility of leakage of sewage into water pipes.

When water must be drawn from a suspicious source, it may be greatly bettered by filtration through a good porous soil. Liquid sewage after slowly passing through six feet of earth answers all the tests of a fairly good drinking water. The water of the Yellowstone is drunk at Fort Keogh, but it is drawn from a well dug fifty yards away from the river, and is a great improvement upon the water of the stream itself. The action of the soil is not merely that of a mechanical filter, but the organisms in the earth oxidize and render harmless a large proportion of the organic compounds in the water.

Of artificial filters sand is the best, and an old sand filter is better than a new one. The particles of sand after a little use become coated with a gelatinous layer which arrests diseased germs, and the sand develops in it organisms which break up organic compounds as ordinary soil does.

The addition of six grains alum to the gallon of water is said to precipitate inorganic impurities and to carry down organic impurities with them. Solution of potassium permanganate, added until the pink tinge remains permanent, oxidizes the organic compounds. Boiling will kill any germs in drinking water, in addition to removing a part of its hardness, and distillation will render it almost absolutely pure.

It should not be forgotten that most germs will survive the freezing process and that the source of the ice supply of a post should be as carefully looked into as the source of the water.

AIR AND SOIL.

The air even of city streets is fairly pure. Notter and Firth and other hygienists point out the remarkable efficiency of the means which nature has provided for the diffusion of the impurities produced by animal life and for their ultimate eradication. A notable means to the latter end is the absorption of carbonic acid gas and the exhalation of oxygen by plant life.

Great as the number of bacteria is to be found clinging to all solid bodies, there are not enough micro-organisms in ordinarily pure air to excite suppuration in a wound from its exposure during the course of a surgical operation. In the beginning of antiseptic surgery it was considered necessary to sterilize the air about the wound by means of a spray of diluted carbolic acid, but this has since been found to be unnecessary.

Malaria, as is well known, is generally produced by the inspiration of air laden with the products of vegetable decomposition. In localities where the soil has long been the resting place, perhaps the breeding ground, of certain endemic diseases (such as cholera in certain parts of India and yellow fever in Havana) the open air may act as the carrier of infection, but, generally speaking, it is the atmosphere of habitations which transmits disease.

This statement impresses upon us the necessity of an efficient system of ventilation. To put it most briefly:—The proper amount of air space per man in habitations is 1000 cubic feet and the atmosphere should be renewed three times per hour. In barracks we have to be content with 600 cubic feet, with more frequent renewal, which should be effected by properly arranged inlets and outlets each having an area of 12 square inches per man. Woodhull considers so great an area of the ventilating apertures unnecessary in our climate. No draughts should be perceptible, and in cold weather the incoming air should be warmed. A fair proportion of both inlets and outlets should be so arranged that they cannot be closed at the will of the occupants. In winter, I have noticed in both street cars and barracks a disposition to shut off all ventilation for the sake of warmth.

In badly ventilated, over-crowded rooms, we have an excess of carbonic acid gas and of moisture, with a perceptible amount of the organic products of respiration.

If these conditions, long continued, do not actually produce disease of themselves, they certainly impair the function of the lungs and lower the general vitality, thus rendering the subject vulnerable to attack. The excessive moisture renders those living in such an atmosphere unduly sensitive to changes of temperature, and the lack of oxygen and excess of carbon

dioxide lead to congestion of the respiratory apparatus, and colds of all sorts are thus contracted.

If you have present, under such circumstances, the germs of epidemic influenza (commonly known as la grippe), pneumonia or tuberculosis, the conditions are most favorable for its development.

In the case of the acute contagious diseases, the atmosphere of the sick room is laden with the germs of diphtheria, scarlet fever, measles, whooping-cough, small-pox or mumps, as the case may be, and the danger of infection to those brought in contact with the sick is enormously increased by bad ventilation.

To the escape of sewer air into houses, the occurrence of some of the above diseases, as well as of typhoid fever, has been ascribed. It behooves every one to see that the sewer system of his house is properly trapped and ventilated, so that all offensive gases may be diffused into the outer air and not into his living rooms. The best trap is the siphon or S shaped trap. There should be a full sized ventilating pipe at the beginning of the soil pipe; ventilation between every two siphons in its course, and before the siphon which seals the entrance into the sewer.

The superficial layers of the soil contain a large proportion of air, varying in amount with its porosity, and in composition with its nature. If your house is built upon a soil impregnated with organic matter, of animal or vegetable origin, the impure soil air is aspirated into the dwelling by the warmed air of the interior. Accordingly, alluvial soils and sands impregnated with organic matter should be avoided as dwelling sites. When circumstances require that they should be so used, the foundation should be laid in concrete if possible, or the building should be raised from the ground and well ventilated beneath.

The movement of the subsoil water has been claimed to have a relation to the occurrence of certain diseases, notably typhoid fever and cholera. Where this water is too near the surface it should be drained by porous pipes.

The conformation of the soil should have consideration in selecting the location of a dwelling site or of a military post. Notter and Firth lay down five conditions for a healthy habitation which are so good that I quote them entire.

A house should have :

1. "A site dry and not malarious and an aspect which gives light and cheerfulness."

2. "A pure supply and proper removal of water, by means of which perfect cleanliness of all parts of the house can be secured."

3. "A system of immediate and perfect sewage removal, which renders it impossible that the air or water shall be contaminated from excreta."

4. "A system of ventilation which carries off all respiratory impurities."

5. "A condition of house construction which insures perfect dryness of the foundation, walls and roof."

FOOD.

For the sake of brevity and not because the subject lacks interest or importance, I shall pass over any consideration of the different classes of foods and their modes of preparation.

The meat of diseased animals, in general, should be rejected, and the meat and milk of tuberculous cattle is particularly dangerous. Trichinosis and tape-worm are contracted from eating underdone pork or beef. Care should be taken in the preservation and storage of food supplies to protect them from decomposition or fermentation and from contamination by impurities of air or soil. In their preparation, impurities of water supply are also to be guarded against.

I shall begin an exceedingly rapid—and I fear an equally dry—survey of the principal infectious diseases with the subject of

MALARIA.

This is a disease produced by the decomposition of vegetation. The poison is in the soil and may be conveyed by water courses as before noted. It is stated that malarial earth when transported from one place to another has given rise to the disease in localities formerly free from it.

Malarial affections are produced by a micro-organism in the blood of those suffering from the disease. The parasite is known as the plasmodium malariæ or corpuscle of Laveran, having been discovered by Laveran, a French army surgeon, in 1880. It has not as yet been isolated from the soil.

Prevention :—In locating a military post or camp in a malarious country, an elevated site, not in the line of any air currents from damp or marshy grounds, should be selected if possible. The soil should be drained thoroughly (by under-drainage, if necessary), undergrowth should be cut away, and the ground covered with grass which should be kept close cropped. Houses should be raised on arches or the second story only occupied. Malarious currents may be intercepted by belts of trees. The early morning and evening air should be avoided if possible. Malarious waters should be boiled or distilled, or at least filtered through sand.

The post of Ft. Sill was practically reclaimed from malaria some years ago by Dr. Morse K. Taylor, on about the lines indicated above.

I have seen small daily doses of quinine (from two to five grains) administered to an entire garrison as a preventive of malaria. On one occasion I gave this remedy in the manner indicated to a whole company with entire success. The early morning is in my opinion the best time to take quinine for this purpose.

CHOLERA.

The discharge from the bowels of cholera patients contains the germ of the disease, the comma bacillus of Koch. These discharges should be thoroughly disinfected as well as all bed and body linen, as these articles are likely to be soiled by the evacuations. Isolation and general disinfection should also be employed.

The soil in certain parts of India and Southern China seems to have become inpregnated with this germ, and it is probably blown about with the dust in the air; but in this country and in Europe, it is principally communicated by contaminated water.

When cholera threatens, extra cleanliness should be enforced about buildings and grounds, and all cases of diarrhœa, however slight, should receive immediate attention, as any inflamed condition of the intestines renders the subject vulnerable to attack.

Experiments have been made on the subject of preventive inoculations, but the value of the method has not yet been determined.

TYPHOID FEVER.

Is accompanied by an ulceration of the intestines and the discharges contain the bacillus of Eberth. The stools and linen should be disinfected as in cholera.

I read in a late medical journal that there are 400,000 cases of this disease in the United States every year, with 40,000 deaths.

Its occurrence is an unfailing indication of bad sanitation. Its almost invariable mode of transmission, is by a water supply which has become contaminated with typhoid excreta.

Whenever an epidemic threatens, all drinking water should be boiled or distilled. Osler, of Baltimore, advises all travellers to drink light wines or mineral waters, rather than the unknown waters of the places through which they are passing.

DIARRHŒA

as ordinarily known, is occassioned by imprudences in diet, but there is a form of epidemic diarrhœa, to which children are particularly liable, which probably depends upon an as yet undiscovered micro-organism in the soil. It has been found that when the temperature of the soil, at a depth of four feet, reaches 56° F., outbreaks of summer diarrhœa begin to occur.

This disease destroys about twenty-five infants out of every thousand births. Notter and Firth say: "Its prevention resolves itself into the avoidance of organic pollution of the soil: the absolute avoidance of made soils, as sites for dwellings; the exclusion of soil air from the house; the careful storage of all food in suitably arranged and well ventilated larders; and the disinfection of all excretal evacuations."

I think personally that summer diarrhœa in infants may largely be prevented by attention to the milk supply and the nursing bottle, and by cool sponging of the whole body in the heat of the day.

DIPHTHERIA

is an acute contagious disease to which children are particularly liable. It is produced by a bacillus known as the Klebs-Lorfler bacillus, and the discharges from the nose and throat contain great numbers of this organism.

It has been asserted to be connected with soil dampness, and there is a popular idea that sewer gas is largely concerned in its

production. The disease has increased of late years in civilized countries.

The only methods of prevention known are general sanitation, absolute quarantine of those ill with the disease, and subsequent thorough disinfection of houses in which it has occurred.

Behring a few years ago introduced the use of an anti-toxin, prepared from the blood serum of horses which have been rendered immune by injections of diphtheritic cultures. Under the use of this remedy the frightful mortality of the disease has been reduced about one-half.

Injections of anti-toxin either prevent the occurrence of the disease in those who have been exposed to the contagion, or greatly modify the attack.

DYSENTERY.

In many wars, more lives have been lost from dysentery than from wounds. It is undoubtedly a germ disease, though its active agent has not yet been isolated. It is largely a disease of hot climates, and its occurrence is aided by sudden changes of temperature, a soil contaminated by fæcal matter, poor food (particularly an excess of salted meats), and depressed conditions of the system.

When dysentery exists, attacks of simple diarrhœa show a tendency to degenerate into the graver disease.

It is to be prevented by thorough disinfection of the stools, the disinfection of all cesspools and privies, attention to the general sanitary condition of the place, improvement in food, and care as to the water supply.

INFLUENZA,

or la Grippe, is a well-known disease which appeared in this country in 1889. It visited England at various times between 1803 and 1860, but was not seen there again for nearly thirty years. It seems to be produced by a small bacillus discovered by Pfeiffer in 1889. It is mildly contagious and its victims should be isolated. Public assemblages and overcrowding assist the spread of the disease.

PNEUMONIA

was thought for ages to be caused by exposure to cold and wet. It is now believed to be due to a coccus discovered some years

ago by Surgeon-General Sternberg in his own saliva. This organism is found in the mouths of many healthy persons, and seems to produce pneumonia only when the vitality of the subject is lowered and his resistance consequently lessened. General sanitation and personal care will do much to prevent the disease. The sputa should be disinfected.

Whooping cough, measles, and mumps are diseases to which childhood is particularly liable, though I have seen an outbreak of the last named among adult colored troops. General sanitation, isolation, and disinfection are the only means of prevention known.

YELLOW FEVER

is a permanent resident of the West Indies. In other words, it is epidemic there, and every few years it is transported from Havana to our southern coast.

It first occurred, in its present habitat, in the 17th century, and an attractive theory with regard to its origin is that of Adouard, who asserted long ago that the poison was first produced by the decomposing dysenteric discharges of the African captives who were packed in between the decks of slave ships, to wallow in their own filth. The bacillus seems to have been discovered in the intestinal contents of yellow fever cadavers by Sternberg, whose surmise appears to have been confirmed recently by Sanarelli (but who claims it as an independent discovery), who had the unusual privilege of experimenting upon human beings with the germ.

If yellow fever is an intestinal disease, as thus appears, much may be done to stop its spread by disinfection of the stools, combined with isolation and general sanitation.

It is the custom in our service to evacuate any post in which the disease appears, and only to reoccupy it after heavy frost and also after thorough disinfection of the place.

SCARLET FEVER

or scarlatina, as it is called by the medical professsion, is a highly infectious disease to which children are particularly liable. The specific germ which produces it, is as yet in some doubt.

It is characterized by a diffuse scarlet eruption of the skin, and during convalescence, the whole cuticle of the patient is

shed in branny scales. Although the contagion is in the throat secretions and breath of the subject of the disease, the principal mode of infection is by means of these scales. The poison will cling for months and years to curtains, carpets, clothing, etc., and reproduce the disease in all its virulence.

This fact emphasizes the necessity of stripping the sick room in cases of infectious disease, of all ornamentation whatever and of all furniture, save the little absolutely necessary for the care of the patient.

It has long been observed that scarlet fever seemed to be propagated by milk, and recent investigation has led to the discovery that cows are subject to a disease characterized by sores on the back and teats and by the kidney symptoms of scarlet fever. Children drinking this milk have scarlet fever; and the chain of proof has been made complete by producing the disease in cattle by inoculation with human scarlatinal virus.

The disease is to be prevented by general sanitation; by closing all schools when it is prevalent; by boiling all milk; by prompt isolation of the sick (which isolation is to be continued foı some time after the peeling of the skin is completed); and by thorough disinfection of houses in which cases have occurred.

SMALL-POX.

This disease, which was formerly the scourge of the civilized world, is now rare, owing to the discovery of vaccination by Jenner, in 1796.

Vaccination should be practiced on all healthy babies, and repeated about once in ten years thereafter. Bovine vaccine only, should be used, and it should be as fresh as possible, as it loses strength when long kept. When cases do occur, they should be isolated at a distance of at least a quarter of a mile from the rest of the population.

TETANUS

or lock-jaw, as it is commonly called, is produced by the entrance of a soil bacillus into wounds. This bacillus is very commonly found in ordinary earth, but has the peculiarity of only growing in the absence of oxygen, so that it is a deep wound, like a nail puncture, the mouth of which closes over, excluding the air, which produces the disease.

Horses often suffer from the disease, and it has been conveyed by septic veterinary instruments.

Prevention is simple. All deep wounds should be laid open and thoroughly disinfected with a solution of bichloride of mercury.

Acute tetanus is a very fatal disease. An antitoxin is now employed in the treatment, but, I believe, not with the same success that attends the use of the diphtheria antitoxin.

HYDROPHOBIA

is chiefly remarkable for the success of the treatment of Pasteur, who renders those who have been infected by the bite of a rabid animal, immune before the stage of incubation of the original poison has passed. This period is generally about six weeks.

Pasteur found that the virulence of the poison contained in the spinal cords of infected rabbits diminished with successive days of drying of the cords. He accordingly starts immunization with an injection from a cord that has been dried for fifteen days, and during fifteen successive days, gradually raises the strength of the injections, until on the last days, the patient receives an injection from a cord that has been dried only five days. The treatment reduces the mortality from 100 per cent. to ½ of 1 per cent.

TUBERCULOSIS.

This disease under its different forms occasions at least one seventh of the deaths in civilized countries. In 1893, 43,632 persons died from it in England and Wales. Its existence is a standing reproach to the medical profession, as, in its prevention, they are, so far, almost helpless and, in its treatment, entirely so.

The disease has been definitely proven to be produced by the bacillus tuberculosis of Koch. Many of the lower animals are susceptible to it, cattle particularly. Children are especially liable to the glandular, intestinal, and meningitic forms of the disease and adolescents (from fifteen to twenty-five) to the pulmonary form.

There are two factors in its production: First, a vulnerability, hereditary or acquired, and second, the presence of the bacillus.

It seems to be contagious only by prolonged contact with

the sick, aided by carelessness in the disposal of the expectorations.

The dried sputum is blown about in the atmosphere, and produces the disease when inhaled by those who have inherited a delicate, weak lung structure, or by those who by confined occupations, poor food (particularly a diet deficient in fats) and a lack of exercise and fresh air have diminished the natural powers of resistance.

Overcrowding and bad ventilation aid its occurrence in every way. By increasing the air space and providing an efficient system of ventilation in barracks, the death rate of the English army from this cause has been reduced from 7.89 to 0.79 per thousand.

All tuberculous meat should be condemned and knives which have been used upon it should be disinfected. Boiling all milk would be a great safeguard for children. Consumptives should habitually expectorate into spittoons containing a solution of chloride of lime or of bichloride of mercury. When abroad they should spit into their handkerchiefs which should be thrown into boiling water after use.

The victim of an hereditary tendency should be reared with special care. A full diet, regular baths, and plenty of exercise in the open air will do much to tide these unfortunates over the dangerous period.

DISINFECTION.

In speaking of the different diseases before noticed, the subject of disinfection has often been mentioned and I shall close this already too long paper by a few remarks on that subject. The object of disinfection is to kill the germs of an existing disease and your efforts should be directed to the special location of the germs of the particular disease in question. For instance, in typhoid fever or cholera you should disinfect the excretions of the patient, by having him void them into a vessel containing, say a pint of 5 per cent. solution of carbolic acid, or an equal quantity of a solution of chloride of lime in the strength of six ounces to the gallon.

The stool should remain some time in this solution and should then be buried. The bed and body linen should be thrown into boiling water as soon as taken from the sick room.

In pneumonia and tuberculosis, the patient should expectorate into one of the solutions before mentioned.

In the graver forms of the acute contagious diseases, such as diphtheria and scarlet fever, the sick room should be stripped of all curtains, rugs, pictures and furniture, save the sick bed and the nurse's table and chair. After the completion of the case, the bed linen, etc., should be boiled, if possible by the nurse, in the room in which it was used.

All apertures in the doors, windows, and fire-place should be carefully caulked up and at least three pounds of sulphur burnt for every thousand cubic feet of air space, the apartment at the same time being filled with steam. The room is to be tightly closed after lighting the sulphur, and is to remain so for twenty-four hours.

After aerial disinfection, the walls and floor are to be swept and the dust is to be burnt. The walls, floor, and furniture are to be carefully scrubbed with corrosive sublimate solution (1 to 500) or better, chloride of lime (1 to 100), being careful that the solution gets into all cracks and crevices. The windows and doors of the room should then be left wide open for several days, to allow free access of pure air.

It is well to supplement these measures by white-washing and painting the room.

Curtains, rugs, and so forth which have been exposed to any chance of infection, should be subjected to a dry heat of 280° Fahrenheit for some hours for several days. As this is difficult to obtain without scorching the articles, I have usually, myself, been content with hanging the articles in an atmosphere of burning sulphur for twenty-four hours, and then having them flap in the winds for days afterwards.

No ill results have followed, but such leniency is wrong, and the disinfection by heat should be enforced. Steam is much better than dry heat but requires special apparatus.

These remarks apply to mumps, measles, and the milder contagious diseases.

When a post is threatened with an epidemic of any sort, the whole place should be gone over most thoroughly. Fallen leaves, chips, horse manure, scraps of all sorts, should be raked out of neglected alleys and burnt.

The drainage, sewerage, and water supply should be looked to, and the privies liberally disinfected with chloride of lime. Every closet and room in every house should be cleaned from garret to cellar, and even the condition of the ground beneath the floors looked to, if possible. With these measures and a liberal use of whitewash and paint, you may feel that your post is in a fairly satisfactory condition.

TELESCOPIC SIGHTS.*

By Lieutenant T. N. Horn, U. S. Artillery.

THIS subject I selected rather hurriedly last year as the first idea my thought suggested. Since that time, I have felt the disadvantage of haste and my inability to properly clothe the skeleton of the title. This paper will, however, confine itself to remarks upon such kinds of sight in connection with field artillery, or rather any artillery not sea-coast. With some modifications my remarks concerning a telescopic sight for the 3.2 gun will apply to others adopted by our Government.

It seems to me that this kind of sight is an absolute future necessity.

Two years ago, the last firing which "A" Battery did with unexpended percussion shell was at the extreme range of the target ground, the target being a 10 × 20 canvas and placed on the hillside, while the guns were close to the river bank. Some of you must remember the day; a sandstorm that was quite disagreeable and blowing almost straight down the range. The target record contains the following remark: "Atmosphere too opaque for good practice." Individual estimates of the range were made from 4000 to 4200 yds., and averaged, it was

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afterward found, the distance was 4160. I think I am correct in quoting Col. Williston, the Inspector of Artillery, as having said it was the best practice he had ever seen, considering all circumstances. Do not imagine the canvas was knocked down, burnt up, or demolished in any way, for it came out nearly unscathed—the hits being very few; but all shots landed well or were good line shots, and could be included in a circle of 100 yds. radius from target. The corporal of the right section, Corp. Benedict, was an excellent gunner and once when ready to fire I looked through his sight. Imagine my astonishment when I saw nothing but a dirty yellow blank. My eyesight always seemed to me very good, so this experience cured me of ever trying to aim a gunner's shot; it also suggested the need of a telescope.

I would like to say here that there seems to be a good deal too much sighting or looking through sights by lieutenants at target practice during the actual firing. If the preliminary sighting drills are carefully conducted, then the battalion orders, strictly observed, should produce the best and most confident gunners. This order says:

"It must be borne in mind that the adjustment of sights and laying of guns pertain exclusively to the gunners (corporals or acting corporals) and while it is the duty of instructors to assure themselves that the prescribed elevations are given and that the guns are properly loaded and pointed, under no circumstances will officers do more than see that required corrections are made by the gunners."

The individual equations of men are always different and a gunner might have his cross wires at lower edge when a lieutenant thinks them at the top of the target. Such difficulties should be corrected at the drills.

SUB-CALIBRE.

In everything we read now, the long range of the infantry weapon governs the tactical uses of the other arms; thus, artillery can never come into action at very close ranges exposed, and, as Captain Wagner says, it may even be necessary to open fire at 5400 yards. Imagine it! 3⅛ miles—Junction City to Fort Riley. How much could we see through the sights with unaided eyes? Surely the artillery must be expected to fire

beyond the limits of human vision. It is said that the extreme limit of shrapnel is 5000 yards, but, owing to the difficulty of observing the effects of a shot, 3000 yards should be considered the extreme useful distance. In short, putting other considerations aside, the limit of range is not that fixed by the power of the guns, but that of the powers of vision. Now haven't we too good a gun to be so limited?

The limit of human vision is regularly known to lie at about 2500 yards when sighting a gun. Some of you must have noticed how difficult it was to see those gun pits through the sight last year! In fact, you will find it some work sighting beyond 1000 yards. The eye was not built to focus and accommodate itself to such extremes as those presented by the breech and muzzle sights close at hand and on objects at an extreme distance. So what use is it to have a gun capable of shooting and being shot within a barn door at two mile ranges when you cannot see the door? Evidently, here, the gunner falls to the rear and the optician steps to the front. The eye must have aid and so the telescopic sight becomes an absolute necessity.

It could be made to stand the "racket" of field work, and the trouble of its care will be more than repaid by the excellence of the shooting it permits; he would be a poor gunner indeed who did poor pointing and laying with such aid as only a telescope could give * * * I wish to read a bit from the "Naval Intelligence." * * *

Of course these remarks apply to the larger ranges and more deliberate firing. When the battle gets hot and fierce, when guns as well as other troops are being crowded to the front, then the field telescope becomes superfluous—the open sight is all sufficient.

The United States field-gun is adopted—the 3.2″ breech-loading steel rifle—and the sights are very good up to their limit. Can any one deny that telescopic aid in the sighting is an advantage, or in other words, are there any disadvantages connected with using telescopic aid? The problem, therefore, is to combine the use of a telescope with our present sights.

In using the breech sight as a range-finder from the estimation of intervals in an opposing battery, have we not had a

good deal of trouble within the range of our drill ground on Pawnee flat even, in fixing the vertical crosswire on a wheel tire on horses heads? What gratifying accuracy would result were our eyes given the aid of a good telescope to bring those obscurities into startling clearness, aud how much more rapidly a range could thus be obtained.

In Colonel Rogers' pamphlet, we are taught the technical rules for regulating the height of bursts of shrapnel; those referring to the laying of adjacent guns with 4′ and 8′ less elevation. The observations taken in this way with a telescope would be of infinitely more value and accuracy than any taken with unaided eyes.

Many seem to think, and rightly, too, that a telescope would give better satisfaction in observing fire than any field-glass made, because of their greater power and, in some cases, more extended fields. The great difficulty is to handle them easily or provide, without great pains, a good fixed support. Now, in action, our batteries have 6 guns. Five might do ordinarily, and thus permit of the employment of the silent piece as an observation telescope. Either flank piece to the windward could be valuably utilized in this way during the firing, for what more stable point of rest could your observing telescope have? Of course field glasses are necessary to sweep the field and for general observations. The use of smokeless powder would increase the advisability of using a telescopic sight, for the enemy will not be so concealed by smoke as heretofore.

I quote two passages from an Ordnance Report showing the relative accuracy of firing a field-gun without and with a telescope:

"In the course of four competitions for rapid firing, I either laid myself, or caused to be laid, 400 rounds on objects invisible to the naked eye at ranges of 4000 to 6000 metres, against a marksman laying with the naked eye at a range of 200 metres, and my results were superior to his notwithstanding the unfavorable conditions." Again:—

"In practice for precision, I had one gun laid with the telescope at a range of 2500 metres against three others firing at 200 metres range and laid with the naked eye, and the rectangle I obtained was four times smaller than theirs."

Such a gain in relative efficiency should settle any doubt as to the advisability of adopting telescopic sights. A disabled telescope would merely throw the gun back to its normal status with the open sights.

In preparing this paper I have had much trouble in getting data—in fact, I haven't *gotten* any except ancient history. Papers on the subject have been written by Captain Scott, Royal Artillery, and Colonel De Cossigny, and published, but my efforts to obtain them were fruitless; so I studied up the Lorain sight, and also one designed by Captain, then Lieutenant Zalinski, in 1882 for trial by the Light Artillery Board. So many improvements have occurred since then that only difficulties of adjustment and delicate construction remain as some of the great sources of error he endeavored to overcome in his somewhat elaborate models.

I had had the idea, in some way, that the Austrian field artillery had largely experimented with telescopic sights, but it seems none have been adopted anywhere and nothing has come of any trials. Lieutenant Allen and Captain Hein both state that the Russians and Austrians won't *bother* with them. If this Government could provide its field-guns with a satisfactory telescopic sight device, our gunners would certainly *bother* an enemy not so provided.

In considering such a device, three things suggest themselves—cost, feasibility, manipulation.

1st. Cost—All will agree it would be insignificant compared to value.

2d. Feasibility—This evidently depends on our ability to adapt it to our present sight.

3d. Manipulation—This ought to be simple and stable, not such that the least jar would seriously impair it.

I wrote to the Information Bureau, War Department, with this result.

OFFICE OF THE CHIEF OF ORDNANCE,
UNITED STATES ARMY,

WASHINGTON, D. C., February 19, 1896.

Lieut. T. N. Horn, 2d Artillery,
Fort Riley, Kansas.

SIR:—In reply to your communication of February 12, to

the Military Information Division, which was referred to this office for answer, I am instructed by the Chief of Ordnance to inform you that no recent tests have been made with telescopic sights for field artillery. The Scott sight, however, is adopted for use with guns mounted on disappearing carriages. Some have been ordered for the 8-inch and some for the 10-inch guns when mounted.

It is not known that any telescopic sights are used for the field service abroad, although many patterns have been tried. In this country a telescopic sight consisting of a simple telescope, suggested by Lieut. Schenck of the U. S. Artillery was experimented with at the Sandy Hook Proving Ground, but the results of the tests were not found satisfactory.

Respectfully,
CHARLES SHALER,
Capt. Ord. Dept., U. S. A.

I have looked through the last nine Chief of Ordnance Reports and also wrote to the *Artillery Journal* for a description of the Scott sight without result.

Capt. Schenck, 2d Artillery, replied to my inquiries as follows:

MY DEAR HORN.

You will find my sight in an article relating to field artillery (material, etc.), published in the JOURNAL M. S. I. about 1889–91—before or after, I don't remember.

The best place for a sight would of course be where it now is; gunner covered by gun when aiming. This may or may not necessitate a long sight like the one I suggested.

If the telescope must be short, it will no doubt have to be placed on or near the left trunnion, and at the time I was at work on the subject, there were many and decided objections by artillery officers in the world to that position for a sight.

I had an optician in Washington verify my work and found that the size indicated for my tube would save about ¾ in. The Ordnance Department had one made out in Ohio, but it was a huge telescope and worthless for the purpose, and nothing like what I specified. I told Colonel Farley so, and

the Department has never done or said anything, so far as I know, about it.

Very truly,

A. D. SCHENCK.

Fort Warren, Mass.,
March 14, '96.

In a M. S. I. article, 1888, I find Capt. Schenck's remarks and suggestions, they refer to the old 3-inch converted rifle, but may be applied with modifications to the present guns. It does seem that the simple principles applied to some target rifles could be adapted to the 3.2″ field piece; and with little changes in the mechanical construction of the present sights—or *additions* rather. The point is to have a telescope secured in the space between the rear peep holes and the intersection of the cross wires, so that the eye would be placed as it is now. In a general way the instrument should be an ordinary telescope "with object glass and eye piece, achromatics and of perfect workmanship and materials, firmly secured in a metal tube from half to three-quarters of an inch, or say an inch in diameter," the eye and object glass having the ordinary focusing adjustments and the eye tube so constructed with side studs and grooves as to permit of the necessary tangential motion caused by lowering and raising the peep hole. The axis of the telescope, or line of sight, must be marked with cross hairs, or better, by lines upon a glass firmly secured and adjusted in the axis of the tube. Fifteen would be a good power. The top of the present sliding bars on the breech sight and the front of the tube should have steel pins for ordinary sighting and short range work. In heavy guns, if the tube proved too long, a bar might take its place, provided with a pair of Y's upon which the telescope could be mounted.

Now the two important requirements are, that the axis of the telescope shall be exactly parallel to the piece axis, when sights are set at zero; and the construction of such a nature as always to include in the axis the two points now used in sighting.

I have examined the sights carefully and think the scheme practicable. The little sliding bar in the breech sight could have an attachment added to it in which the tube or bar could

be inserted; should a bar below the telescope be used, having Y's, then the bar also must be removable.

Over the trunnion, a radical change would be best, and so, ball and socket construction would be necessary, on account of the movement of the breech sight. Consider one moment the simplicity of such a construction. Have two small brass uprights with inside grooves, and two corresponding lugs oppositely and accurately placed on the spherical ball—what could be easier to slip up and down? The point now occupied by the crosswire intersection would be at the centre of the sphere, a point on the telescopic axis. To guard against the result of a possible damage to the tube, the gunner should be provided with a simple front sight like the present, properly encased. How simple then to restore our present arrangement by slipping this into the grooves of the brass uprights. Added to this, a small screw should be run through the deflection slide of the rear sight to clamp the instrument.

Suppose for a moment two guns supplied with devices like the proposed. To find a range, No. 1 aims a short shot, No. 2 aims also the same. No. 1 fires. If No. 2, without changing the gun, run the cross-wires on the point of impact and clamp carefully, his sight will now reach both range and deviation.

Another thing I have not mentioned is the advantage to a gunner in having his telescope unattached. After returning breech sight to its pouch, he can use the tube as a hand telescope for observation.

I had intended preparing some drawings and specifications of what has been roughly submitted, but was unable to do so for various reasons.

Considering how much we seem to need a telescopic sight, it is strange the subject has been so ignored, and yet there must be reason for it. I sincerely hope, however, our excellent field-gun will not much longer be handicapped by the need of some such contrivance to make sure of its efficiency at the long ranges.

Perhaps if my duties fall again with a light battery after this summer, I may find them in use, for the subject is worthy of attention.

BATTLE UNDER THE NEW CONDITIONS.*

By First Lieutenant HENRY C. DAVIS, 7th U. S. Artillery.

INTRODUCTION.

SINCE the last great war, improvements have been made in fire-arms of all kinds, and in the ammunition used. What effect these will have is largely a matter of speculation. In 1866, the Austrians trusted greatly in their artillery, while the Prussian faith was pinned to the needle-gun. Both of these arms came up to expectation; the former nearly destroying the centre of the First Army early in the day at Königgrätz, and the latter turning the tide in favor of the Prussians on the right. The French in 1870 looked to the mitrailleuse and chassepôt, while the Germans hoped, by a reconstruction of artillery methods, to gain the ascendency. In both these wars, each side rested its hopes on some special feature of its armament. Even knowing the results, is it possible to say that these hopes were well or badly founded when so many other factors entered? In the next war the chances are that no such difference in material will exist as has heretofore been found in the opposing ranks. For this reason we may evaluate the new unknown quantities only by the law of probabilities.

FACTS.

Closely following the great improvements in artillery and small-arms came:

1. Magazine rifles.
2. Small calibres.
3. Smokeless powder.

The effect of magazine rifles has been to increase greatly the number of rounds that may be fired in a given time. The rate, depending on the type, averages about twenty per minute. This gives very rapid fire, and if kept up will exhaust the supply of

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ammunition carried by one man in eight to ten minutes. The pieces grow very hot at this rate of firing, but, due to the special arrangements, may be handled even afer firing 100 shots. In some types, the magazine may be cut off and the piece used as a single loader till the critical moment (Danish, English, French, Swiss); while in others (Austrian, Belgian, German), there is no cut off.

The calibre of the infantry has been steadily reduced and it does not yet appear to have touched bottom at 70 mm. The navy has adopted a 2.3 cal. rifle in 1893. This reduction has resulted in a flatter trajectory, longer range, and higher remaining velocity for the same initial velocity. From this we obtain an increased dangerous space, and, with present initial velocity, a shot, fired from near the ground, with the piece sighted for and aimed at an object 550 yards distant, will not rise above a man's head. The rifles are sighted for 2000 yards and over, and the German rifle bullet at that range will penetrate 2 inches of wood; more than sufficient to penetrate to the vital parts of man or horse.

With reference to the accuracy of the small calibres, Captain Blunt, Ord. Dept., reports that of fifteen shots fired at a target twenty feet by thirty feet, range 2000 yards, from a 30 cal. rifle, twelve hits were made. The conditions were the most favorable.

Recoil is now less for several reasons, hence men can fire with much less shock to the system than formerly.

The ammunition is about one-third lighter, thus a larger supply may be carried. The Chileans carried 180 to 200 Mannlicher cartridges into action.

The noise of discharge is less now than formerly. This is attributed by some to the use of smokeless powder *per se*, but is most probably due to the small charges now used. This fact finds its most important bearing in reconnoissance and outpost duty (not considered in this paper).

The aggregate amount of noise on the battle-field will be about the same as before on account of more rapid fire of infantry, due to the repeating arms, and of the artillery, due to the absence of smoke, and because all shells will burst. The noise will be still sufficient, probably, to allow of marching to the sound of the guns, although the sound of the autumn ma-

nœuvres battles closely resembled that of a distant storm and might have been easily mistaken for it.

The new powder affects the conditions of battle in two distinct ways, viz.: by giving increased initial velocity to projectiles and by ridding the field of the presence of smoke, alike advantageous and disadvantageous, and always uncontrollable. The first increases the gains already noted under reduced calibre; the second requires special notice.

The new powder gives on burning no solid residue, and hence there is no smoke. The condensed gas, or probably the union of the nitrogen with the oxygen of the atmosphere, gives a vapor visible at short distances and rapidly dissipated. This vapor cannot be seen, at effective ranges, from either artillery or small-arms. An eye-witness of the Italian Manœuvres of 1890 says: "A battery remained in action half an hour without being seen." Again he says: "at 2500 yards a brilliant flash only is seen by the naked eye and what to the field glasses seemed smoke was found to be dust raised by the blast."

With a moist atmosphere the vapor becomes more apparent but never obscures vision. The flashes from artillery become more apparent in the absence of smoke, but, unless looking directly at it, one finds great difficulty in locating the place exactly.

The new small-arms then:
Will kill over a more extended space:
Will kill at a greater distance:
Will fire a greater number of shots in a given time:
Will allow the carrying of a greater number of cartridges:
Will give no smoke to obscure vision:
Will make less noise for the single shot than formerly.

GENERAL CONSIDERATIONS.

The increased range and accuracy of small-arms must inevitably win back some of the ground lost to artillery after the improvements in the manufacture and manipulation of that arm. The chassepôt did some execution to batteries, in column, at 1800 yds., so it may confidently be expected that fire from the new rifle, under favorable conditions, will be quite effective against them at 1200 yds. This is more evidently true now

that the smoke of battle no longer obscures the field of view. A line of sharpshooters, well posted, under cover, will make it very uncomfortable for any battery in that range, and, if nothing but their general direction is known, their dislodgment will be a serious question. A single Bavarian sharpshooter, in a tree at Sédan, annoyed a French battery very much, as his position remained undiscovered.

It is claimed, and justly too, that artillery in 1870, before the day of powerful shrapnel, protected its own front against infantry attack, provided always that it was in action when attacked and that the advancing troops were seen at a sufficiently great distance. Will it be possible, even with shrapnel, to *drive off* a line of skirmishers firing from no one knows where? It seems that the balance is somewhat restored under the new conditions.

Increased range in small-arms assures to a straight front a certain amount of flanking, provided the front is not engaged on its entire length ; also bodies of reserves, if bountifully provided with ammunition, may fire from commanding positions in rear or on the flank, and, assisted by the artillery, give a strong covering fire for an attacking line or seriously retard the advance of a pursuing enemy.

Increase in range and rapidity of fire will make the flank attack more powerful and demoralizing. If the flank fire is delivered unexpectedly from good cover, and furthermore if, due to absence of smoke, the assailant's position is not discovered, a very few rounds will tell on even the best of troops.

On the other hand, a flank attack will be more difficult to make; for a small force can contain the flanking party sufficiently long to prevent the movement being a surprise. If time is given to prepare for its reception, a flank attack, unless overwhelming, loses half its significance.

The magazine rifle of to-day is, so long as ammunition lasts, always loaded and ready to be fired. It was this characteristic possessed in a less degree, and in connection with increased range, that gave the needle-gun its superiority in 1866.

From early times shock tactics has been used. At first both sides were necessarily on the offensive; but, with the invention of missile weapons, particularly fire-arms, defensive tactics came

to light. It was boldly asserted that this weapon would give a decided advantage to the defensive. To the theorist this has always been clearly proven from the consideration that the defense is stationary and partially protected, while the offensive is moving and unprotected. The former then can load and aim his piece more easily than the latter. Granted; but does not this very fact prove conclusively that all improvements in firearms, with reference to loading, aiming, and firing, conduce to the equalization of advantages on the two sides? There remains, of course, the advantage of cover for the defense, but he is tied to it, and to gain any decided advantage he must quit it and in his turn take the offensive.

The flat trajectory and increased length of continuous danger space (550 yards) will prevent troops from advancing into this zone till the opposing fire is broken down. This then seems to give the limit to the zone of decisive action.

The absence of smoke from the field of battle cannot change any principle of tactics, since it is but a covering or screen, differing from that given by natural objects only in the fact that it is impossible to avoid it when it becomes hurtful. This absence of smoke emphasizes the principle of "seeing and not being seen," since it renders the realization more possible. Smoke gives cover for manœuvres, and so lessens losses; it makes feasible the replenishing of ammunition and even sometimes, by concealing losses, sustains the morale of the troops. "The line of puffs gives the Commander-in-chief a clear idea of the position of the fighting line, the dense clouds indicating the position of the artillery." The direction of the blasts, shown by the smoke, often, after many movements of the troops, alone indicates to which side the firing line belongs.

On the other hand, in the absence of smoke, men see better and so judge distances better; they see what is before them, and, if intelligently brave, will advance the more readily. It is claimed that noise and smoke keep up the courage. If that is so, the effect is on the nervous system and men will, just as probably, imagine dangers that do not exist. Napier relates an incident of troops who, advancing bravely under a heavy fire to the very works of the enemy, broke in disorder at the false alarm of a mine.

As a cover to the firing line, smoke is a disadvantage, for cover at the expense of accurate fire is strictly forbidden by all modern fire regulations, and smoke prevents accurate fire to a greater degree than it gives cover. It is then a disadvantage to troops actually engaged, though beneficial to others.

In the absence of smoke, fire is more effective and orders are given and obeyed more intelligently. The whistle, already adopted, may be used to attract attention, and signals, clearly seen, may be given and understood. Men are more easily kept in hand; the fall of officers and non-commissioned officers is more quickly observed, and their places more readily filled. Surprises to the advancing line are less easily made as the dispositions of the opposing forces are less easily hidden. Natural cover is easily seen and the advancing line is directed on it. The direction of the wind often favors one side or the other, but when there is no smoke this element of chance is eliminated.

The artillery is probably more affected by smoke than any other arm. Under cover of its own smoke, a battery sometimes changes position without much risk, thus causing the enemy to lose the range, and, if at the same time the opposing battery is enveloped in smoke, this alteration in range is not noticed. The ruse, often adopted, of changing position under cover of smoke, is no longer feasible.

To counterbalance these advantages derived from the presence of smoke there are numerous disadvantages. Smoke prevents the accurate sighting of the piece, or, at least, makes the firing slower; it prevents the observation of shots; it conceals the target, it gives a cover under which infantry or cavalry may advance to short range before being discovered, as in the German manœuvres of 1879, when a regiment of lancers charged a battery and were not seen till at 200 yards.

Smoke is specially annoying to artillery, due to the fact that it usually fires a great many shots from the same position and the smoke collects around it. This is doubly distressing, as firing is its only means of defense, and the benefits that should be derived from its accurate fire and long range are lost to it. That artillery must be massed is a settled fact. Smoke requires that guns occupy more space than otherwise needed, and Prince Kraft cites many cases where more guns were available than

there was room to put them; so they were crowded out. With no smoke, they will be crowded in.

Again, firing was begun on one flank or the other, according to the direction of the wind, and positions could not be occupied to the best advantage so long as smoke interfered with a good view. Absence of smoke will clear all this away. It will enable a battery to take a covered position and fire away for some time without its positions being discovered. It has been suggested, as necessary to discover the position of such a battery, that the direction of shot furrows be noted. Though not practical, this indicates that fire from unseen batteries is expected in the future.

Without smoke we shall not, as at Sadowa, hear of infantry advancing, unseen, to such short range that the artillery, unable to defend itself, is captured.

MORALE.

The principal changes in the conditions of the battle-field which affect morale are:

1. Everything not concealed by the terrain is clearly seen.
2. Losses may be sustained from an undiscovered source.
3. With increased range and accuracy, losses may be inflicted at greater distances.
4. With increased facilities for loading, a more spirited attack or defense may be made and ammunition sooner expended.
5. The difference in effect of the large and small calibres on the wounded.

How these changes will affect morale must also be evaluated by the law of probabilities. The Chilean war affords little information, as but one third of the Congressists were armed with the small calibre rifle (about 3000 men); while none of the Balmacedists were so armed. To draw any conclusion from this is to fall into the very common error of noting an effect on a side which has not a corresponding advantage to support its morale. The aggressive use of artillery by the Germans is now accepted as the correct thing; but suppose their opponents had been equally aggressive and as well prepared, what then?

To be able to return fire and that effectively, is a condition most bracing to the morale of the troops. Vertical fire is always most trying because it cannot be returned, and little shelter can be gotten from it. Hence fire at long range from an unseen foe will certainly try the courage of the best of troops. It must not be allowed to continue, the enemy must be discovered and driven off; or the field must be so occupied that no such position can be taken up by the enemy. Skill then must here protect morale or troops will falter.

Morale is fired off with the last cartridge, now so easily reached, and nothing but relief from fire or replenishing ammunition will restore it. Skill must again come to the rescue and so control fire that ammunition and necessity for using it will pass at the same time. Failing this, skill must devise some method of replenishing the supply. In both these cases skill on the battle-field is referred to.

To counterbalance the moral effect of the other conditions, skill must be used beforehand in instilling into the troops the idea that they have equal, if not better, chances of success than their opponents. Troops must be taught to believe that they can and are doing at least the same execution as they see produced on themselves.

It is not "the number of men killed" that determines the combat, but the "number scared"—the number who believe themselves whipped or forced to retire. Otherwise a line could never be driven back by fire alone, for, so long as a single man remained unhit, the line, a thin one it is true, would remain.

But man is a gregarious animal, morally as well as socially. He needs something to support his courage; "the touch of elbow," even though metaphorically true, only gives the external support needed, while confidence in his own ability and that of his commander gives the inward.

It is often stated that a frontal attack cannot be made. Why? Is it because all the troops will be killed? Not at all, but because the morale will be killed. If this is true, should not all tactics look to the preservation of morale first and that of life second? Why is a flank attacked so fruitful of results, when the number of men actually killed *at first*, is less than for a frontal attack? It is because the troops so attacked *feel* themselves at

a disadvantage—their morale is lowered. The same applies to a night attack where relatively few lives are lost.

The meaning of all this is that the morale plays a great part in all battle-fields, and that all tactics must take it into grave consideration.

It is claimed that the absence of smoke will allow troops to see comrades fall and their commanders taken away and hence will lower their morale. This is true, but tactical combinations must be so made that the skillful directors may quickly see these effects and counteract them, so far as officers are concerned, by filling the vacant places. The men must feel that what they see is also seen by those whom they trust, and that all possible care will be taken to abate the evil. This points directly to decentralization: the killing of a single man must affect fewer men on the firing line; there must be a greater number on this line authorized to take the initiative in the matter of assuming direction of affairs.

Few men, when struck, take the tragic attitude of the picture books, hence the loss of a commander's voice will probably sooner attract the attention of the men than the loss of comrades. The absence of smoke will then greatly facilitate the counteracting of this evil, provided that skill is used beforehand in making tactical combinations and, on the field, in carrying out what has been provided.

Absence of smoke will allow a better grasp on the combatants and will also allow the men to better feel this grasp. On the other hand, if not kept well in hand, troops will see it more quickly now than formerly and lose morale.

A clear view will allow a clearer insight into the enemy's line; if the fire is telling on him, the first waver will be detected and advantage taken of it; or, if he begins to advance, the first initiative can be seen and possibly nipped in the bud.

What does all this mean? Simply that the field is cleared for skillful action. The professional swordsman and amateur are on the same level when blindfolded and using crude weapons; uncover their eyes and give them good weapons, and the conditions are at once changed. The anxiety of workers in the dark is recognized by those who now doubt the practicability of firing all heavy guns by a central power, assigning as one reason

that the strain on the nerves of the men serving the piece is too great while they are waiting for the unseen hand to touch the button.

Men must be taught that they are as good as their opponents (and care must be taken that they are). They must be confident of their ability to handle their improved weapons skillfully. They must believe not only that the weapon is as good as any, but that they can get as much good out of it as any one else can.

It is feared that in battle men will not use their sights and take aim before firing. If all have been taught how and the need for it, when battle comes *some* will do so; if not so taught, *none* will. In some recently published articles, target practice is descried and a battle scene is depicted in which, so far as the description goes, there appeared to be nothing more than a whoop, a rush and a general confusion in which any lessons from the target range could have only been worse than useless and in which every man was as good as another. Without gainsaying this statement, as regards the old smoke methods, one can but fail to agree entirely with this view under the new conditions of battle.

Confidence in himself and in his ability to take intelligently all cover that enables him the better to use his piece according to his and its merit, must be deeply rooted in the mind of the soldier of the future.

The difference in effect on the nervous system of a hit by a large and a small calibre bullet is a matter that writers on the subject seem to ignore. With equal remaining velocities, the force stored up in the small is not quite half that in the large one. In order that the energy in the two may be the same, the velocity of the small bullet must be 50 per cent. greater than that of the large one: as this is about the increase expected for initial velocity in the United States, and as the sectional density of the two bullets is practically the same, the mv^2 at equal distances will be higher in the heavy than in the light bullet. On striking, the small bullet will experience less resistance, be more apt to penetrate entirely, and so afford less nervous shock to the wounded. No wound is so demoralizing to the spectators as that by the fragment of a shell, because the result is so ghastly. Now surgeons, in the Chilean war, report that the

wounds from the small calibres are specially clean cut and but little blood flows; the wounds, moreover, are more easily and quickly cured, and a smaller per cent. are mortal. A correspondent, writing from the field of battle, says that the new bullet should satisfy the philanthropist, for it either kills outright or not at all.

As a matter of morale, would it not be worth while, since we must face the dreadful rapid-shooters, to refer oftener to this fact than to the ability of the small bullet to penetrate two or three men? The proportion of hits to the number rendered *hors de combat*, will doubtless be the same, but the effect on those left will be less trying.

Again, will this small bullet stop a charging horse? A man hit will probably stop, but not so with a horse, unless he is killed outright. Hunters of game no larger than the horse use a heavier bullet than that of the old rifle; while with elephants, the explosive bullet is found necessary.

ARTILLERY.

Before the introduction of smokeless powder, two principles in the use of this arm seem to have been well established:

1. That artillery must act aggressively;
2. That it must be massed.

There seems to be nothing in the new conditions to change either of the above rules, and indeed the absence of smoke but enables them to be better carried out and adds to the results obtained.

The field gun is a weapon of precision, and must be carefully aimed. The clear atmosphere adds greatly to the possibility of doing this; more skill and less luck is required now than formerly. Batteries or even pieces, if desirable, may now fire entirely independently of each other and of the direction of the wind. They may fire more rapidly, not waiting for the smoke to clear away.

If the increased range of small-arms has rendered infantry a more formidable adversary, the absence of smoke has at least rendered it a visible one. Attacking lines can no longer, as in the past, approach to short range under cover of smoke.

More pieces may now occupy a given space, and may even, if the terrain permit, be placed in tiers without in the least interfering with each other.

Due to the absence of smoke in its own and in the infantry firing lines, covering fire may be the longer maintained.

The battery is a better target than formerly, but as it is in more danger when coming into action than after it opens fire, and as it makes no smoke before firing, the advantage of smoke as a covering disappears, especially so, when considered in connection with its subsequent blinding effect on the gunners.

Being a better target, artillery must now doubtless endeavor to obtain all shelter compatible with its efficiency in firing. This means a more intelligent reconnoissance of the whole field, especially as to all possible artillery positions. Batteries must not run the risk, unnecessarily, of coming into action at points exposed to fire, possibly from unseen guns or skirmishers. (An artillery officer should make this reconnoissance.)

As soon as practicable, a line of skirmishers should be pushed out on the flank and front, to prevent the hostile skirmishers from taking positions within effective small-arms range. This becomes more important as time goes on, for it is well-known that troops, earnestly engaged in front, often allow movements to pass unnoticed, which, under other circumstanees would certainly be seen.

When practicable, guns will be unlimbered under cover and run into position by hand. They will, as in 1870, occupy the firing line, but the feat of unlimbering on that line, under heavy artillery and infantry fire, is to-day quite dangerous, hence to require it the necessity must be urgent.

It is folly to say that any given manœuvre is impossible, for on the battle-field all these rules are broken: the necessity for risking a sacrifice is all that is needed in order to have really good troops attempt anything. Artillery on the skirmish, or even on the firing line, may be a necessity to sustain the infantry morale: if so, let it go in, even though it is clearly seen that, except in special cases, it can really do little good as it marches forward. Its true place is in some well-selected site, there to remain.

Pieces may be pushed forward to crown captured lines but, even under these conditions, its best place may be where it commands the captured line.

There is nothing in the new conditions to change the regulations as to the targets to be fired at, but it seems that the method of range-finding should be improved. A battery should not fire until it can hit, and this should be as soon after coming into action as possible: no more shots should be lost than necesary. To accomplish this the range must be more accurately approximated before firing is opened. This is the more important, since the artillery can then give the range to the infantry as it arrives on the line.

After the issue is joined, it would seem important that one piece, at least, occupy itself with finding the range to all the possible positions to the front and flanks, for, in the absence of smoke, a field of a mile and a half radius may thus have any part of it suddenly covered with the projectiles of hundreds of guns.

It may, in the absence of smoke of bursting shells, be difficult to determine their point of fall: if this is true, range-finding shell filled with black powder may be used. Experience alone will determine; book writers are silent on the subject.

Shrapnel will be effective at longer ranges than before, owing to the fact that, with high explosive filling, the velocity of the fragments and bullets is more independent of the remaining velocity of the shell. For the same reason shrapnel will be more effective in searching cover.

INFANTRY.

Frontal attacks have been made in the past and will be made in the future; it will be fatal to teach the contrary to any army. Flank attacks will be made as heretofore and, as heretofore, must be accompanied by strong attempts in front. Troops must expect to be called on to make these attempts, and also schooled to bear heavier losses than heretofore in doing so. A greater responsibility rests with the commander; he must be fertile in expedients and make no blunders.

In what formation shall the attack be made? No cast-iron rule can be given; each nation must decide for itself. The

character of the troops, their morale and their traditions enter the problem. It is said that Napoleon was forced, by the deteriorated condition of his later levies, to use the column attack to a greater extent than he believed in.

The column attack has passed, but there are advocates of a closed line attack,—an elbow-to-elbow advance.

Since fire tactics replaced that of shock, every endeavor has been to obtain a greater development of fire, and the front will now be as thoroughly covered with men as the free use of their weapons will allow, even approaching an elbow-to-elbow advance. The advance is clearly seen and the opposing fire will be withering; the return must be equally so. All cover possible, not detrimental to accurate fire, must be taken; sub-commanders must be skilled in selecting such cover and in getting men out of it when the time comes to advance.

Firing by one section of the line to cover the advance of the other, will have less effect now than formerly, as there will be nothing to indicate to the enemy which section is firing (unless its front be considerable), and so the return fire will not be specially directed on that one. The line must go forward in small units and the exact time of advancing and stopping must rest largely with those lowest in command.

The decisive fire, for reasons already given, will begin at 600 or 700 yards. Volley firing will be impracticable except at long ranges; the skill of the troops, the character of the target, and the available ammunition will determine its use. The moral effect of a volley may be worth considering, but its efficiency cannot be more than 75 per cent. of that of individual fire. Smokeless powder favors individual firing; giving to good, cool shots an opportunity to do excellent work.

Every conceivable opinion has been put forward relative to the rate of advance of the firing line as well as to its formation. Some argue that the rate, slow at first, should be accelerated, and that the line, without stop, should move upon and into the enemy's position. Others hold that the advance by rushes is correct, but that the halts should be long and frequent at first, allowing good shots to get in their work; the number and length of halts must increase as the line advances, the firing here being done more at random. Still a third idea is just the

reverse of the last. All agree to the final rush when the way has been prepared. A happy mean seems the best course; when the ground is open and no shelter exists, advance rapidly; in firing, use the magazine. When shelter is afforded, make intelligent use of it; fire less rapidly and more accurately. Heretofore reserves and supports were, to a great extent, hidden from view by smoke, and little or no direct firing was done on them; new reserves, in rear, may occupy themselves entirely with this target, and, with the artillery, may produce considerable havoc there.

Since reserves and supports must be kept well in hand, their deployment must be postponed as long as possible, varying in each case; due to the accuracy of artillery fire and the penetrating capacity of the small-arms bullet, it would seem that extension in depth should be sedulously avoided; before deploying they should be in line and in single rank. Deployment will take place, not at any fixed number of yards, but, according to circumstances.

The battle tactics, in the U. S. drill regulations, is good; some of the details and the wording of some of the commands might be improved on or omitted; these, however, are unimportant, and will be corrected in battle.

So far as infantry is concerned, the new conditions have made both offense and defense more difficult without, on the whole, giving any material advantage to either. All cases will give rise to circumstances which skillful leadership, on either side, may turn to advantage. That side which is quickest to see and most skillful to grasp will get the best of it.

CAVALRY.

Recent changes have enhanced the value of good cavalry while worthless cavalry will be more in the way than ever.

The mobility of cavalry gives it its power. It must be here, there and anywhere; not only before a battle, but during and after it.

As information as to the enemy is of more importance to the Commander-in-chief than ever before, the cavalry must be able to furnish all that is necessary, and at the same time keep up a screen against the enemy's scouts and patrols. To "see

and not to be seen" is as important before a battle as during its progress, and after the battle too, if the best results are expected from a victory. It is already required that artillery be attached to cavalry: if, in addition to this, the cavalry is armed with a long-range carbine which it knows how to use, the supporting column of light infantry, usually attached for important expeditions, may be left behind with a gain of mobility. This reconnaissance work is of the utmost importance, and the proper performance of it will bring more credit to the arm and be of more importance to the Commander-in-chief, than anything else that it can do.

It has been noted that all artillery will push to the front to open the combat; also that it will there be in danger from unseen infantry, and will need a cordon about its front and flanks. If infantry is to supply this guard, the artillery must do without it or wait till the infantry can get up. Here seems an opening for carbine cavalry; it can even precede the artillery and find out just what is before it. With this cavalry will ride the artillery officer who is to make the reconnaissance and fix upon the artillery positions.

As soon as any serious resistance is met, the cavalry dismounts and throws out a line of skirmishers in front of the proposed positions. These may or may not be relieved when the infantry gets up. The opposing force will, of course, do the same thing, and skill in this preliminary work will tell in the subsequent battle.

During the battle, the cavalry will have its hands full in watching the flanks of its own army, and in demonstrating on those of the enemy. The exact progress of the Crown Prince at Königgrätz should have been known to Benedek, and his arrival should not, as regards time, have been in the least a surprise.

It seems useless to discuss the ability of cavalry to attack infantry successfully on the battle-field, when there are so many more important duties awaiting it. A similar case would be the feasibility of cutting up the winter's supply of wood with a razor, forgetting the while that, the feat being performed, one must either go unshaven or perforce use the axe for that purpose. There is no question of bravery with the cavalry, but,

in this day of advanced methods employing perfected material, each arm is used to its utmost extent and in that work which it is most fitted to perform.

If infantry has been shaken, there is no question of cavalry's overtaking it and harassing it more than footmen can; this is directly in line with the cavalry's work—to pursue, overtake and keep contact with the retreating infantry, is the part of a cavalry which hopes, efficiently, to play the part of information bureau.

If cavalry is to be able to attack unshaken infantry, it must have at least the same front as its opponent, and must move to the attack in a boot-to-boot formation. Even the advocates of this do not hold that the cavalry will attack infantry in sight, but that it will do so at a favorable time. Where will this large body of cavalry be kept beforehand? for, as long as it is within a mile and a half of the artillery, unless hidden by the terrain, it will be continually harassed by the now accurate fire of that arm, and when it begins its charge, no better target could be asked for for the guns and neighboring masses of infantry with their long-range rifles. The air is now clear, and all infantry and guns within 2000 yards may participate in the fire, and we might easily have a Balaclava on every battle-field.

Cavalry has not, in spite of some writers, "sung the song of the swan," on the contrary it is more necessary than ever; but, like the artillery, it must drop some of its traditions and, in this day of specialties, recognize that, in any complicated mechanism, each element is specially fitted for and must perform a single part, supporting and supported by the others.

There are circumstances when a sacrifice is called for: in this case "be sure you're right, then go ahead"; use the razor on the wood pile, expecting its ruin.

MACHINE GUNS.

Theoretically, these guns should take the place of whole companies of infantry, but, practically they do not seem to work. They are complicated and liable to fall at the critical moment. They are not infantry, neither are they artillery: if sent on the firing line, the artillery will easily knock them out: if kept behind, they cannot be ranged.

Circumstances have arisen when they might have proven very valuable. But how can they be kept on hand when needed, and out of the way when not? They were not successful against a civilized enemy, nor were they more so against the savage Soudanese, and they do not seem to have hit anything at Alexandria.

They may be successful in more or less permanent works, but what their future reach is, is too problematic to predict.

SIEGE OPERATIONS.

"The absence of smoke allows the besieger to establish his guns of the first position, for indirect fire, more securely hidden from the besieged. At this stage the advantage is with the assailant. The nearer the approach, the less evident is this advantage: at the assault, the new conditions give the advantage to the defense, if he is still in condition to use it."

"The guns will longer occupy the first position, and, indeed, the heavier calibres may not be moved up at all, the démolition being completed at that range."

SUMMARY.

1. Infantry will, at all times, be more dangerous to artillery, and will not depend on the accident of smoke, etc., to be a very formidable assailant to that arm.

2. Flanking fire is obtainable from straight lines: good flank attacks will be more effective though more difficult to make.

3. Improvements in small-arms, thereby increasing facilities for loading and firing, inure to the benefit of the attacking troops.

4. Increased danger space has put back the line of decisive action.

5. Smoke is advantageous to the Commander-in-chief and to all troops not firing, but a disadvantage to the firing line: and conclusively.

6. The artillery arm is the one most affected by smoke, and the advantages derived from its absence greatly overbalance the corresponding disadvantages.

7. The usefulness of cavalry is increased but its rôle is changed.

8. In siege operations, the new conditions give the advantage to the assailant during the first stages, afterwards to the besieged.

6. The future of machine guns is still too uncertain to predict.

CONCLUSION.

The greater the skill of the troops and of their commanders, the greater are the advantages accruing to them under the new condition.

To him that hath shall be given.

Credit.—It would be difficult to give credit to authors whose views may appear above, as the foregoing consists of the ideas formulated in my mind after reading much of the mass of current literature on this subject, and, after giving the subject much thought, mingling my own ideas with those of others.

MILITARY DISCIPLINE: ITS CHARACTER, ACQUIREMENT AND USE.*

By Major JAMES CHESTER, U. S. Army.

A QUEER subject, perhaps, to select for discussion before so many veterans. But a little consideration will, I think, excuse, if it does not justify the selection. The subject is old but not obsolete. It is the constant factor in our professional equation, and it cannot be altered or eliminated by modern inventions. It is to-day, exactly what it was in the days of Nimrod, and it will continue unchanged while human nature continues what it is.

Discipline is, or ought to be, the distinguishing feature of standing armies. Not that it is peculiar to them as such, for it existed long before standing armies, as we understand the term, were dreamed of. The feudal lord, the tribal chief, in short, every tyrant who had power over life and limb, maintained a discipline much more exacting than that required by any articles of war. Discipline was necessary to national existence. No doubt there were then, as there are now, believers in the power of numbers and personal pluck, but history has failed to record their successes. On the contrary she has recorded many of their failures. From the days when Darius summoned his subject nations to overwhelm the Macedonian's handful of disciplined troops, to the latest illustration when the Chinese giant was brought to his knees by his dwarfish but disciplined neighbor, the record has been one-sided throughout. Within certain limits discipline has defeated numbers every time. It is often unpleasant to make special application of the teachings of history, but facts may be stated without offense. Undisciplined armies, whatever their numerical strength, are a danger to the State. Law and liberty, and majority rule, are lovely enough in time of peace; but loveliness is not at home in war. All these beauties must stand aside in favor of discipline, if war is to be waged with success. And discipline is a tyrant. She brooks no rival and will acknowledge no eleventh-hour worshippers.

* Read to the Army and Navy Club, Washington, D. C., in March, 1898.

Shams find no place in her armies. She must reign in the heart or not at all.

Government by discipline is akin to the government of gods, and therefore seems to be despotic. It is despotic. There is no room in the line of battle for a town meeting; and as the discipline of peace should be the discipline of war, town-meeting methods are out of place at any time. Discipline means efficiency. Maintain it, then, or disband the army. Why waste the revenues on a worthless machine? But a disciplined army is an excellent investment. Somebody has counted the loss which our nation sustained, by not having a disciplined force of 30,000 men in 1861. I do not propose to inflict the figures upon this audience. They are immense, and to me incomprehensible. But if even the thousandth part of the value they represent could have been saved by the existence of a disciplined army in 1861, the proposition to discuss discipline needs no apology, even in an association of veterans.

Military discipline is peculiar and therefore often misunderstood. It cannot be taught by preaching; it cannot be learned from books; it cannot be explained to the laity. Its methods are repugnant to democracy. Many of the people honestly believe that it should have for its foundation a majority vote. But the men who know it, who have been trained in its methods, and have witnessed its operation, know better. They know that there can be be but one commanding officer in an army, and that his orders must be obeyed. Moreover, they admit that military discipline in a military organization is not only necessary and useful, but also benevolent. Of course some men acquire it with difficulty. They think it tyranny, and they complain. Fortunately they are an insignificant minority in the army. Discipline requires a long apprenticeship. It takes time for it to percolate, slowly and silently into the very soul of a man. He receives it partly by practice and partly by absorption, and he is always unconscious of its arrival. He thinks he is learning his drill and doing his duty. These he is doing of course, and at the same time learning the lesson that makes him a soldier. He is unconsciously acquiring military discipline. Civilians as a rule know nothing about this process. Like the soldier in the ranks they rarely look below the surface. Indeed their ideas of

military discipline are very defective. Ask any intelligent citizen what he understands by military discipline, and judge my assertion by his answer. But we can settle the point without putting the intelligent citizen on the stand. We can turn to the dictionaries. What do the lexicographers say about it?

The Century, the latest and fullest dictionary of our language, gives six definitions of the word, and not one of them would be accepted by a professional soldier as its military meaning. The nearest approach thereto, perhaps, is the fourth definition, where it says "Punishment inflicted by way of correction and training." But military discipline is not necessarily punishment. The author of that definition had his eye on the church and not on the army when he wrote it. The verb "To discipline" has also many definitions, not one of which is military. The most military among them, perhaps, is where it says "To train or educate; to teach rules and practice, and accustom to order and subordination; to drill." But there is something wanting in even the closest of these definitions. Turning to Webster we find seven definitions of discipline, one of them —the sixth—being ecclesiastical; but strange to say, not one exclusively military. This proves, better than the answer of any civilian, that military discipline is either misunderstood by, or altogether unknown to, the laity. Certainly, if the lexicographers know that there is such a thing as military discipline they misunderstand its meaning. This is manifest from the way in which they join teaching and training, as if they were synonymous terms. Now, as already said, military discipline cannot be taught. No manly virtue or useful accomplishment can be acquired in that way. In the Wisdom of Solomon we read "Train up a child in the way he should go, and when he is old he will not depart from it." We have no such assurance from any one in authority about teaching. Yet there are many military Gradgrinds in these enlightened days.

The processes by which a man is transformed into a soldier are, collectively, called discipline. When spoken of separately they are known as drill, training, and punishment. The first applies to the soldier in the ranks, the second to the soldier at all other times, and the third to the soldier in rebellion. But the word training might be made to cover all three branches.

A soldier is always under training, either by experience or observation. The lesson he has to learn is so important that he is required to practice it all the time he is awake. He is drilled until he knows his drill; then he is drilled until he acquires discipline; and then he is drilled to keep him from forgetting it. And when he does forget it, his memory is revived by punishment. Moreover, when he is not on drill or undergoing punishment, he is being badgered by the non-commissioned officers of his company, every one of whom, when he says "come" insists that he the learner shall come, and when he says "go," he shall go, and when he says "do this," he shall promptly and cheerfully do it. The Roman centurion's idea of discipline is far in advance of the modern lexicographers.

To the outsider, and even to the soldier in the ranks, this continual drill after the exercises have been learned seems perfectly absurd. Parade, for instance, seems to be a senseless ceremony. Some believe it to be merely an ostentatious or vainglorious display; others assert that it is for the amusement of the spectators, generally children and nursery maids. Both are wrong. Parade is a training in discipline. It is one of the ways in which a soldier acquires the great accomplishment of his life. So is drill—all kinds of drill—every exercise in which subordinates are required to promptly execute the orders of a superior, is a part of that eternal training. Of course, drills have another purpose, namely, imparting a knowledge of the drill. But that is a simple matter and soon accomplished. The continuation *ad infinitum* is a training in discipline.

What then is discipline? What is that great military accomplishment without which no man can be classified as a soldier? In a word, it is obedience—unthinking, instinctive, prompt and cheerful obedience. Every incident in the soldier's life, from the moment he swears the enlistment oath until he is finally mustered out by death or discharge from the service, is part of his training in that great accomplishment. He is learning the lesson of his life throughout his career, and nothing should be allowed to interrupt it. He begins by swearing "To obey the orders of the officers appointed over him," and his whole military career is an effort to keep that oath. If he

succeeds, he is a soldier. If he fails, he is a sham. The strict enforcement of discipline, then, is a benevolence to the soldier. Laxity in that line is almost criminal. A good commander will never permit his men to perjure themselves if he can help it.

Discipline then, means keeping the oath of obedience, and it applies to every grade in the hierarchy. All have sworn to obey, and all must be made to keep their oath. They have voluntarily subjected themselves to military discipline as outlined in the articles of war and they cannot justly complain if they are held to a strict compliance with the contract. So far as military discipline is concerned, what is sauce for the goose is also sauce for the gander. From the General-in-chief to the rawest recruit, all must obey.

Is it necessary to argue that a man cannot acquire military discipline by merely swearing to obey? Perhaps there are audiences which might need such an argument; but this is not one of them. I shall, therefore, assume that that proposition is proved. Its corollary, therefore, must be accepted. Raw levies are not disciplined. This audience can appreciate the difference between trained battalions and similar organizations which have only learned the drill and taken the oath. Popular orators sometimes flatter the nation with references to 1861, when the patriotism and pluck of the people furnished fighting men faster than the Government could arm them. And that certainly was something to be proud of. But the armies thus created were not very effective machines. They could kill each other fairly well, but they could not gather the fruits of victory. If either of the armies at Bull Run had been a disciplined army, that battle would have ended the unpleasantness in favor of the side that had the disciplined force. And how much money, not to mention valuable lives, would have been saved to the nation by that?

I have always been something of a heretic myself, in military matters, and some of my opinions may require seasoning; but I feel that I have a host of friends around me when I say that I love the old soldier. I love him because he is disciplined. He may have all the weaknesses of humanity, but if he has thoroughly learned the lesson of obedience he is worth a dozen

recruits. I should like to see, at least one-half the army seasoned soldiers—not men who have merely learned the drill, but men who have also acquired the discipline. And I hold that three years are not enough for the average man to learn that great lesson. I know that in the armies of Continental Europe, soldiers serve only three years, or less, with the colors. I know also that continental nations have elected to rely on numbers for success. But I do not know how their raw levies—for they are nothing else—would stand a conflict with half their number of disciplined troops. When all doubts on that point are dispelled, I fully believe that the vast armaments of Continental Europe will disappear, and that the nations will rely thereafter less upon numbers and more upon discipline than they do at present.

Armies cannot exist without some kind of discipline. Where there is no obedience there will soon be disintegration. There is obedience in the armies of Continental Europe; but it is the obedience of fear, or the obedience of discretion. It is the obedience of the convict or that of the conscript. It is rational and not instinctive obedience; and whenever the danger to be faced by obedience is greater than the danger to be feared from punishment for disobedience, it will fail.

Military discipline is invaluable because it never reasons. It never thinks of dangers or consequences. It acts instinctively, and its actions are as easy and unpremeditated as winking. It takes time to acquire that kind of discipline. It cannot be acquired in three years. Short service is a mistake. Standing armies should be professional armies throughout, or as nearly so as their methods of recruitment will permit. A composite army, partly professional and partly amateur, must be unreliable. Its professional part is the measure of its strength. Its amateur part is the measure of its weakness. In an emergency such an organization may prove to be a balky team.

It is difficult to determine theoretically the relative value of trained and untrained troops—and by trained I mean not only drilled but disciplined—because the ratio changes within certain limits, with numerical strength. Taking the extreme at the minimum end, that is, one man against another, the discipline of the trained soldier would give him no advantage over

his undisciplined adversary. He would be his own master in such a conflict, and have no orders to obey. An organized squad, however, of disciplined soldiers would be more than a match for any unorganized mob of equal numerical strength. To state that the ratio in such a contest would be two to one in favor of discipline, would be a modest statement. And this ratio increases with the numerical strength. A disciplined army corps is a perfect military machine. An armed body of undisciplined men of equal numerical strength would be unmanageable. I should say, then, that an army corps of disciplined troops would be more than a match for any number of undisciplined men. If that be true, and I think it is, an army corps of disciplined troops is a handy thing for any nation to have.

I have said that a disciplined soldier rarely knows how he acquired the accomplishment; and men even, who administer discipline, rarely know how it should be cultivated. Issuing orders and punishing disobedience are, undoubtedly, important parts of the process; but the unpretentious way by which a good man who needs no punishment acquires it, is often overlooked. Personally, I had never given a thought to the subject until a certain experience in Columbia, S. C., in 1868, set me a thinking. Up to that time, if I had any clear ideas on the subject at all, they were that good men needed no discipline. Only bad men, disobedient, and contumacious men needed that kind of medicine. But in 1868, during reconstruction times, when army officers however inexperienced were assumed to be able to do anything, I was detailed on a Board to investigate the discipline practiced in the penitentiary of South Carolina. The investigation was exhaustive, and the Board having no experience of its own to guide it in its judgment, put itself in communication with the governors of many celebrated prisons in this country and in Canada. The methods of discipline reported by the various prison authorities set me thinking on the subject. Army officers at that time were called upon to discipline some queer specimens of humanity. There was much of that kind of material in the army during the ten years that followed the war. But bad as some of the men were, they were not a circumstance to the scoundrels whom society had found it necessary to send to Sing Sing. Criminals who neither feared

God nor regarded man, and who had been at war with society all their lives, were constantly coming to that institution, and every new arrival needed discipline.

There then, in an exaggerated form, perhaps, was the very problem which army officers frequently encountered in those days. How did the prison people solve it? Simply by drill and punishment. The man with a rebellious spirit was readily recognized, and selected for drill. The drill was simple enough. The commands were "Open your mouth. Shut it. Open it. Shut it," *ad infinitum.* Of course the rebellious spirit, after a dozen repetitions of the absurd command, failed to obey, and punishment followed. So many minutes in the shower bath, after which the drill was resumed and prosecuted to a second disobedience and punishment, or until the subject obeyed mechanically. Then the drill would be varied by making the prisoner open and shut his eyes at command, or raise and lower his arms, or anything, the absurder the better. And the drill was continued until discipline was established. Pure *cussedness* will always yield to persistency.

The study of penitentiary methods opened my eyes to the true value of much in the military service. The manual of arms, and ordinary barrack-yard drill, after the men are able to execute them perfectly, are the military counterparts of the discipline drills of our penitentiaries.

But the supreme test of discipline is found on the battle-field. The commander of an army of volunteers, hastily assembled; imperfectly drilled; and entirely untrained, depends largely upon the patriotism and personal pluck of his men to carry them across the deadly zone. The commander of regular troops depends upon discipline. It is needless to say who stands the better chances of getting across. It was discipline and not patriotism or personal pluck that carried the Light Brigade down the Valley of Death at Balaklava. Somebody had blundered, and the brigade knew it. But it was not for them to *Reason why!* Discipline demanded obedience and not a soldier swerved. As an illustration of discipline that blunder is worth a dozen victories. It proclaims a truth which the nations, in their worship of man-killing machinery and numerical strength, have almost forgotten.

Imagine for a moment the mental condition of the 600 men which constituted the Light Brigade when they started on their death ride. It must have been akin to hypnotism. Seemingly unconscious of the dangers that surrounded them, they rode for the guns, and then, rode back again, if they were of the lucky few that escaped, and hardly realized that they had been in danger until it was past. And it is the same with every forlorn hope. The Gordon Highlanders in their assault upon the almost impregnable position of the Afridis, showed the same spirit. And that spirit is cultivated, if not created, by such seemingly nonsensical exercises as Eyes Right, Front, and the rest of the gamut, *ad infinitum.*

Personal pluck is not rare among men, but it is not always reliable, except, perhaps, in single combat. Where men combine, either for attack or defense, the leader needs it, but the followers will do better with discipline. In all collective actions the essentials of success are discipline in the ranks and courage in the commander. In proof of this Clive's experience in India, with the naturally timid, not to say cowardly, Sepoys, which English officers have recently repeated with the fellaheen of Egypt, might be cited. In both cases discipline worked a transformation little less than miraculous. In the latter case the transformation had been noted by the newspaper men. They unanimously declared that the English had made soldiers out of the Egyptians. But when the eye of genius was turned in that direction the real magician stood revealed. It was Sergeant "What's his Name" that did it, and his discoverer has immortalized him in a few stanzas which I wish I were able to repeat. But you have all read them, no doubt. They register a fact which is too often overlooked. The drill-sergeant is the real doctor of discipline.

The courage—so called—of a company, or any other military organization, is the courage of its commander. It has no reference to the men in the ranks. Their merit, if they have any, is in their discipline. If they fail to follow their leader they are not necessarily cowards. They are only undisciplined.

The courage that enables a man to stand up and be shot at, is not uncommon among men. Thomas Carlyle says courage to do that sort of thing "has not been denied to any man or

woman." And as proof of that assertion he goes on to say: "Do not recruiting sergeants drum through the streets of manufacturing towns, and collect ragged losels enough, every one of whom, if once dressed in red, and trained a little, will receive fire cheerfully for the small sum of one shilling per diem, and have the soul blown out of him at last with perfect propriety."

If Carlyle had known as much about Tommy Atkins as Kipling did, he would have known that the red coat had nothing to do with it. Not the coat but the training, not the tailor but Sergeant "What's his Name," nerves the ragged losel to stand up and have the soul blown out of him. And Carlyle erred in characterizing the training as "little." It is not little, but large and long. Before the ragged losel is ready to stand up and have the soul blown out of him, he has to undergo a training compared to which that of the undergraduate is easy and even short. Sergeant What's-his-Name literally licks him into shape, and when the operation is over he is not only drilled but disciplined.

The power of discipline is difficult to explain. I remember a case in point before the war, which has always been somewhat puzzling to me. It was in 1856, if I remember rightly, at Fort Monroe, Va. The garrison at that time consisted of a detachment of ordnance, two companies of artillery, and one regiment of infantry. At that time the arsenal was inside the fort, in what was called the Ordnance Bastion. The buildings in that narrow space were packed together like sardines in a box. There were workshops, store rooms, laboratories and barracks, not to mention magazines in the adjacent casemates containing tons of gunpowder. The 4th of July was approaching, and the ordnance detachment had been working for weeks preparing fireworks for its celebration.

Everything was about ready. The store rooms were well filled with fireworks of every kind, when about noon on a certain day an explosion occurred, and in less time than it takes to describe it, the arsenal was ablaze, and an impromptu and unexpected display of fireworks which baffles description, was in energetic action.

It was evident from the first that the buildings could not be saved, certainly not the store rooms; so the efforts of the men

were directed towards saving as much of their contents as possible. The scene was a perfect pandemonium of fire. Shells were bursting singly and in groups, and a steam engine was madly at work inside the burning workshop. The men had become accustomed to the shells. The artillerymen knew they were paper bombs for the 4th of July, and the infantrymen took courage from their example. But some one said that the steam boiler was about to burst, and from that moment not a man would approach the building. Jefferson C. Davis, then a lieutenant, was in immediate charge of the salvage party, but even his energy and some forcible language failed to induce anybody to follow him into what they believed to be the jaws of death. Colonel Francis Taylor, of the artillery, who up to that moment had been a spectator, seeing the difficulty or rather the impossibility of controlling the men without organization, directed Davis to get the men in ranks, and then march them wherever he wished to have them. This was done and the men marched into the burning building without a murmur. As an unorganized mass they were uncontrollable. In the ranks, discipline asserted itself, and the men could be marched anywhere.

The philosophy of discipline is too big a subject to be dealt with at the end of a paper. Still, one can hardly pass by such a mysterious phenomenon as discipline without the eternal "Why?" demanding some kind of an answer. Why will soldiers in the ranks do things at the command of an officer, which they could neither be coaxed nor driven into by the same officer when out of ranks? No doubt the habit of obedience acquired during years of training has a heap to do with it; but why should that habit of obedience be inoperative when the men were out of ranks? It is not the formation in my opinion, but the silence which that formation imposes, that works the miracle. Silence in the ranks insures obedience provided the men are disciplined soldiers. The instinct of self-preservation is common to all animals, the human animal included. No man faces deadly peril without some fear. The soldier entering on his first battle, and, I believe, entering on every battle, feels this instinct strong upon him. But he thinks he is the only man in the company that feels that way, and he is in mortal

terror that his comrades will find him out. And so he suppresses the instinct, and will do anything however daring or even reckless, at command. But if he could talk to his comrades right and left, he would soon find out that they feel just as he did. After that understanding was reached, is would be an easy matter to find an excuse for slipping out of ranks and becoming skulkers, or standing fast at the command *Forward! Guide Centre.*

Only one word more. The conservation of discipline means the life and usefulness of the army. Conservation, therefore, is as important as creation, and it is entrusted to officers of every grade in the hierarchy. The drill-sergeant may be the principal agent in imparting to the men that habit of obedience, which, in the trained soldier, becomes a second nature; but all officers and non-commissioned officers in their respective spheres are charged with its conservation. In this important duty they stand together, under the motto "Discipline must be maintained." Everything is secondary to that. Of course, in the lower grades of the hierarchy, inexperience and errors of judgment are to be expected. These must be corrected, but always in a way that will not weaken his authority if the erring officer is to remain a member of the hierarchy. The machinery of discipline is delicately adjusted. Any part of it may be wholly removed and replaced, without serious injury to the machine; but no part of it can be weakened or distorted without destroying its usefulness.

Reprints and Translations.

"COÖPERATION BETWEEN THE ARMY AND NAVY."

By Admiral P. H. COLOMB.

(*Aldershot Military Society Papers.*)

GROWTH IN RECOGNITION OF COÖPERATION BETWEEN THE SERVICES.

NO one who has been long watching the signs of the times in matters relating to the two great military services can avoid noticing how much more their mutual interlacing for offensive and defensive purposes is recognized now than it was a few years ago. The interlacing has always been there, at least since regular forces have existed, and since our contests with the Dutch began to develop principles of naval warfare. But till lately we failed to notice it, or try to understand its principles. During war these principles became so instinctively understood that no one thought of writing of them; and when war ceased, and there were no writings to fall back upon, we forgot all about them.

The result was that up to about 15 years ago naval thinkers scarcely considered what share the army had in establishing the naval position, and military thinkers only considered what was to happen "in the absence of the fleet."

The general result is that we are only slowly shaking off a number of mistaken conceptions, which occasionally seem to be the more firmly rooted just because they are so near their fall. These mistaken conceptions were a few years ago perhaps more ingrained in the navy than in the army, and I am bound to say that in any case the navy has been at the bottom of them, if it has been more active of late in trying to shake them off.

COÖPERATION IN ATTACK ALREADY DEALT WITH.

In 1891, when his Royal Highness honored us by presiding, I read a paper in this hall which dealt pretty fully with the coöperation in attack; so that it is not necessary to enlarge on that subject again.

COÖPERATION IN DEFENSE; THE SUBJECT OF THE PRESENT PAPER.

It follows that what we have now to consider is coöperation in defense, and we shall see that this is a vast and very complex question, very little understood; but lying at the base of almost all our naval and military policy, and governing it, if we are acting rightly and reasonably.

This kind of coöperation naturally falls for discussion under three heads:—(1) Coöperation in defense of commerce; (2) Coöperation in defense of outlying territories; and (3) Coöperation in defense of the United Kingdom.

FUNDAMENTAL DIFFICULTY IN UTTERANCES OF PUBLIC MEN.

The moment we attempt to open the whole subject, we are met by a fundamental difficulty which exists in the utterances of public men. They always use a formula which sounds weighty and seems to mean a great deal, but is really only a block to discussion, and a preventive of definition. The formula is that the speaker will not range himself amongst those who declare for trusting the defense of the United Kingdom, or the empire, entirely to the navy. The inference is that the question of defense is between those who claim coöperation in defense, and what is called "the extreme naval school," who consider, for instance, "that any attempt to make our home defense forces effective on land is an insult to the navy." When, then, public men speak as if the question were between coöperation and no coöperation, we have to open a long proof to show that that never was and never could be the question, before we can touch on what the nature of that coöperation is. It becomes immensely difficult to offer proof, because we are met by the inquiry: Why then it did arise if it never was the question? And the only answer is to read sentence after sentence written by members of the so-called extreme naval school, and to show that men have been reading between the lines and putting into them meanings which never were there.

I am not going to attempt to do that, only to ask you to take my word for it that this extreme naval school does not exist, and that the only question which those who are so stigmatized raised is, what are the principles upon which the army and navy coöperate for defense in war? As we stand, I shall try to show you that the utmost confusion reigns, and that a few years ago the navy was asking the army to perform impossibilities, and categorically refusing coöperation; while the army is sometimes distinctly laying it down now that the navy has no defensive powers whatever, and that military policy must rest on that basis.

I quite believe that the navy itself is most to blame for the confusion. The army wrote and read on what might be called the philosophy of land war. It drew principles from history and extracted the laws, obedience to which led to success, and neglect of which to ruin, in the conduct of war. The navy did not write, and therefore could not read, about the philosophy of sea war. It had no notion of principles drawn from history—that is from experience. We ought not to wonder that when what two great but opposed admirals wrote more than 200 years ago is produced as evidence of the existence of a fundamental principle of naval war—of all others the most important for the army to under-

stand—an able military writer should tell us that he "has been bored to death with this phantom," and should "pray heaven that Mahan may have sent it to the bottom never to rise again." Of course this writer does not go to de Tourville, and to Lord Torrington, his opponent, each saying the same thing, for a notion of what is meant. He reads into modern writers' expressions things that are not really there, and is most properly desirous of being delivered from such nonsense.

But it is not this writer's fault that he fails to apprehend. The navy has too suddenly awakened to its true position, and though its instincts have enabled it to grasp the situation more quickly, it has not yet acquired the power of conveying it to others outside the service, except in a very few cases.

LATE DOINGS AND SAYINGS IN REGARD TO COÖPERATION.

Let us examine to some extent what we have been doing and saying more or less officially of late years on the subject of coöperation.

In the year 1789 a question was raised as to the openness to attack by the enemy of the naval depots of Portsmouth and Plymouth, and a Royal Commission issued to examine it. It was clearly understood that their defense was a matter of coöperation, and it was assumed, for the purposes of the inquiry, that either port might be, in the temporary absence of the Channel fleet, open to an attack by 30,000 men if they could be assured of 30 clear days to operate in before the fleet returned. The Commission was divided in opinion, and so was the House of Commons, which by the casting vote of the Speaker decided that such an attack was impossible, and refused the money to increase the fortifications. Sir John Jervis, afterwards the great Lord St. Vincent, led the section that carried the day, and it pronounced that the coöperation of the navy could not fail in the defense, for that it was impossible the Channel fleet could be absent if such an attack were in the air.

In 1859 the same question arose, and a Royal Commission issued; but the reference assumed the entire absence of naval coöperation. As a fact, the question had already been decided, for great expense had been incurred on the hypothesis that the navy would not coöperate, and there was therefore no data given as to the force which might attack, and the time that might be available before the fleet was able to coöperate. But the idea that naval coöperation was little in mind was shown by the composition of the Commission, four military officers, two naval officers, and one civilian.

Some of the conclusions the Commission came to were as follows:

"Even if it were possible that a fleet sufficient to meet the emergency of a sudden naval combination against this country could be kept available and fully manned in time of peace, such an application of the resources of the nation would lead to an outlay of the public revenue far exceeding the expenditure which would suffice for that object under

other circumstances." Whatever the meaning of this somewhat obscure paragraph may be, it seems designed to show that the navy could not be expected to coöperate with the army in defense.

They said "they were led to the opinion that neither our fleet, nor our standing army, nor our volunteer forces, nor even the three combined, could be relied on as sufficient in themselves for the security of the kingdom against foreign invasion." It may not be easy to know what was meant by this, but it excluded any notion of considering cooperation, because of its uselessness.

Their sense of the strategy of the question was shown by their agreement that a French fleet and army might be attacking Plymouth, while a superior British fleet was just outside the Channel mouth. The statement was that the British fleet could not attack the French fleet, because it must remain in its outside position in order to protect commerce. This, which reads like another *reductio ad absurdum*, was certainly not so considered at the time. It is certain that one at least of the naval members was thoroughly imbued with the belief that the country would never provide a supreme navy; and down to a very few years before his death, in 1888, his ideas hung upon that view. From evidence given by other naval officers, however, it may be supposed that had there been equal naval and military strength on the Commission, coöperation could not have been excluded from the report.

In 1888 Mr. Stanhope appointed a committee to inquire into the defenses of our mercantile ports in the United Kingdom. On this committee was a single naval officer, and though he endeavored to point out that, in his opinion, the attack to be expected would be on our shipping, not on our ports, it was not to be expected that a single voice would change the color of a report which took no note whatever of naval cooperation.

I think we may agree that, on the face of things, the defense of ports was a joint matter as between the army and the navy; and yet we see that we beg the question, and in the formation of our committees in that behalf, decide that the coöperation from the navy to be expected is at least small.

We are still on the question of coöperation in defense of the United Kingdom, and we must review for a moment what the opinions of the Admiralty have been, as disclosed by their acts. In the early seventies the Admiralty built, at a cost of more than a million, six ironclad ships. They were not fit to keep the sea; they were hardly safe to go to sea; they had so small a coal supply that it was certain they could not go far from port. The supposition in building them clearly was that we must expect the enemy's fleets over on our own shores as an ordinary occurrence in war. The construction of these ironclads embodied the same ideas as the great fortifications of Portsmouth and Plymouth did. Either that we should not in future, as we had done in the past, endeavor to maintain our fleets in observation of the enemy's fleets in his own ports,

and that we should therefore leave them free to put to sea, to go, we could not tell whither; or that we could not undertake this for want of force. The Admiralty evidently conceived a state of war in the future which had never been in the past; and which, when they afterwards reflected, was seen to be a most unlikely state. Their ironclads, which are now officially termed "coast defense ships," were too slow to be called into operation unless they happened to be at the place attacked at the time the attack took place. They were a great deal too powerful in armor and armament, and also too slow, to act as commerce protectors round the coast. The idea, therefore, was to station them singly at the different ports which were assumed as peculiarly open to attack. There were also built, near about the same time, a great number of gunboats, each carrying a single armor-piercing gun; but the boats were devoid of sea-going and sea-keeping qualities. These, like the coast defense ironclads, were designed to be stationed locally, not to defend our shipping from those audacious attacks of light swift vessels in our own waters from which we suffered so much after the battle of Trafalgar, this they were incapable of doing, but to offer opposition to groups or detachments of the enemy's most powerful ships which might come into our waters with designs not clearly settled, perhaps because they were never examined.

The leading idea here might well have been coöperation with the army in its forts and batteries in defense of home ports, but the coöperation of the regular navy was excluded, and its want of influence, as well as its absence, was assumed. It seemed also to be altogether forgotten that the British Islands were no longer self-sustaining, and were as open to attack by investment as by assault. And yet it was not assault in the only promising form, that of a great invasion, that was in contemplation. Neither the fortifications nor the coast defense ships were in any way designed to prevent invasion, for as the Royal Commission had pointed out, it left 700 miles of unprotected landing places quite open to invasion. What was looked for, apparently, were isolated attacks upon the shores of ports by the most valuable of the enemy's ships. We had no experience of such methods of warfare since 1667; and practically our own experience of any sort of attack on a home port was that of Thurot on Carrickfergus in 1760, which the navy immediately converted into such a disastrous fiasco for the enemy as to make its ever being tried again extremely doubtful.

It is pretty certain that not many years elapsed before the Admiralty understood that all these ideas were incapable of standing against argument, and the changed view was shown by their policy in regard to torpedo boats. Foreign countries, in building enormous numbers of these boats, believed them to be a most effective and inexpensive defense of their home waters. All their experience was in the line of seeing their ports blockaded, their shores attacked, and their towns burnt by British ships, which settled down permanently in their waters and even occu-

pied their islands and grew vegetables for the fleet on them. It was experience that dictated the enormous supply of torpedo boats which might possibly be capable of keeping the British further from their shores than heretofore. There was immense clamor raised against our Admiralty because they did not follow suit. But they were not to be moved. They now understood that before they could be called on to defend our home waters with torpedo boats, there must have been imperial collapse, and that the question would be suing for peace, not defending our ports against attack. There must have been absolute failure of the navy to coöperate in defense.

But presently the Admiralty fully met the clamor by building considerable numbers of torpedo vessels designed, not to operate in home waters, but to drive the enemy's torpedo boats off their own waters and into their ports, so that our fleets could once more, if war came, take up their old rôle of observing the fleets of the enemy in the closest way, and making sure that they did not get to sea with impunity. This was to recognize not only naval coöperation, but to indicate that the old principle of naval coöperation—observation of the enemy's naval forces wherever they might be—was once more reëstablished so far as the United Kingdom was concerned.

I have no such distinct indications of what the present view of cooperation in defense of outlying territories may be, or of the principles, if any, now acknowledged. But thirteen years ago one of our ablest naval officers, who held the highest offices, and was deservedly recognized as a great authority, expressed the firmest conviction that there could be no coöperation between the army and the navy in the defense of what he thought were of supreme, if not of vital consequence to the very existence of the navy, its outlying depots and ports of supply.

He spoke of "the urgent necessity for placing our naval stations abroad in such a state that they could defend themselves against the attacks of an enemy's squadron without relying on the presence of our ships for that purpose." He thought that "Malta was the only one of our naval stations that could then be considered as efficiently protected against an attack by a hostile squadron, even when the defense was assisted by submarine mines." He declared that "the services of our fleets would be required in all parts of the world for the protection of our commercial ports, of our commerce and shipping, and above all for the attack of the enemy's ports and destruction of his commerce. None could be relied on for the protection of our naval depots."

He wrote thus almost before the term "Command of the Sea" was in use, and when hardly any one had written of the conception of naval warfare that that term involved.

He wrote at a time when it was certain that our navy was much inferior to that of France and Russia combined, and doubtful whether it was not inferior to that of France alone. The navy estimates then came to only £11,000,000, or less than half their present amount, and the

Times, representing the public view, deprecated a large expenditure on shipbuilding, and declared it to be a mistake to count too closely the opposing numbers of ships and guns, saying that Jervis and Nelson never did so.

If you consider this language regarding outlying and isolated territories side by side with the acts of the Admiralty in building great numbers of vessels unfit for anything but the local defense of the ports of the United Kingdom, you will see, I think, in both cases a loss of the idea that the primary duty of the navy is to keep itself in close observation of all the naval forces of the enemy. On the other hand, the refusal of the Admiralty at a later date to build port defense torpedo boats, and the building instead of sea-going torpedo vessels, perfectly competent to operate in observation on the enemy's coasts, is, I think you will agree with me, a recovery of that idea. And you may see, with me, a parallel recovery of the same idea in the qualifying expression used by the officer I have been quoting, a few years later.

He then said that such places as Malta, Gibraltar, Aden, etc., should only be made "capable of protecting themselves against any force that might reasonably be expected to be brought against them, and be prepared to stand a siege *until relieved by our fleet.*" Here you see the uncompromising character of the earlier utterance passes away and the principle of coöperation is admitted.

THE TWO CONCEPTIONS OF THE ACTION OF SEA POWER.

I think you may note that these official and semi-official acts and words exhibit two opposite conceptions of the action of sea power. In the one, the naval forces of each belligerent are coming freely over the sea in all parts of the world. No fundamental principle of strategy governs their movements. The chief object of each is to attack and conquer territory, or at least to destroy the enemy's property on the land that is get'ta-ble by squadrons. There is no particular design of bringing fleets and squadrons face to face in order that the superior power should clear the seas of the other. The question of superior or inferior power scarcely arises, for it is assumed that the one power is attacking the territories of the other with his ships, while the other is making reprisals in the same manner.

The conception is naval attack of territory everywhere, and the whole scheme of defense rests upon the fortification of the places open to attack by ships, upon the garrisons, and upon ships that are incapable of moving away from the forts they defend. Coöperation between the navies and armies is wholly confined to the action of these floating batteries in conjunction with the garrisons of the ports.

In this conception the only defense allotted to the navy is the defense of commerce, but the conception goes no further than merely to mention it. It is assumed that protection to commerce is compatible with allowing the ports that commerce flows into and out of to be

blocked by the enemy either as an end, or as a preliminary to their attack.

In the other conception, the whole endeavor of the one power is to clear the seas of the other, in the firm belief that until the whole of the enemy's naval forces are driven into port and closely observed there, there is, and can be, no complete protection either for commerce or territory. The conception is that the action of the navy is wholly defensive; but it is defensive of the sea-territory as including defense of the merchant and other ships passing over it, and of the ports out of which they issue and those to which they return. Not until the enemy's navy is driven into his port and watched there, or at least so weakened that it can no longer interfere, does the winning power think of the attack on territory. He will not, if he can help it, run the risk of having his operations interfered with and his communications with his base cut by the appearance of the enemy's squadrons in his rear during his attack. So that he will make no attack on territory until he has locked up safely the enemy's fleets.

The first conception excludes the idea of coöperation between the army and navy in defense except locally as described.

A superficial view of the other conception might judge that as it throws the whole idea of defense upon the navy locking up and observing all the forces of the enemy that could possibly attack, so it excludes, just as much as the other conception does, the idea of coöperation. No doubt if the conception can be carried into practice absolutely, this is so. If the navy can succeed in completely closing in the enemy's naval forces, so that nothing puts to sea, the navy has completely protected commerce and territory, and there is nothing for the army to defend; then, indeed, all the military forces and all the naval forces not actually engaged in observing, are free to assemble for the purposes of coöperation in attack. But the point is that though our policy might proceed to arrange itself on this conception, it would be foolish to suppose that we could carry it out completely. Granting that our naval forces are in such quantity as to enable us to keep up the strictest observation physically possible on every warship of the enemy, the physically possible is a wide term, and it cannot be hoped that the observation will be in all cases perfect. If evading squadrons escape to sea, and there is no coöperating army garrisoning within suitable works our outlying territories, what is to prevent the enemy from carrying them?

Here then is the coöperation. It is plain that the naval force which has been observing that particular naval force of the enemy that has evaded it, has nothing more to observe. Its intended coöperation with the army has broken down in its primary form; but in its secondary form it is bound to follow up the evading squadron and prevent its doing mischief. If it has intelligence of its whereabouts it flies after it; if it has no intelligence it falls back to that central rendezvous which has been appointed as that where the earliest intelligence will reach it.

Whichever be the case there is inevitable lapse of time. The co-operation, and the only coöperation, it can justly ask at the hands of the army is to hold out in any attacked point during that lapse of time. It is a time which is fairly measurable; for it only includes the time that it may reasonably take for intelligence to reach the rendezvous, and then the time it will take to steam from the rendezvous to the place attacked.

We come to another point in this conception. Views the most divergent exist as to the powers of observation that modern fleets possess. I am not going to argue how much or how little they may have, though I believe the point is determinable by proper and sufficient experiment. But we shall all accept it that a small force, observed by a small force, has naturally much greater powers of evading it than a large force has of evading a large force. The reason of the thing therefore points out that under the principles sketched, large garrisons and powerful works are hardly needed; and this for another reason, namely, that supposing a large expedition being able to evade a large observing force, everything about it involves more time in delivering the attack, and cuts the time short in which it can operate before the evaded fleet arrives to crush it. The enemy, knowing this, is the less likely to contemplate running the risk.

With this conception in our minds it is therefore quite impossible to agree with the dicta in the words quoted: (1) That because the navy must protect "our commercial ports, our commerce and shipping," therefore it will not coöperate in the defense of our coaling stations and ports of supply. (2) That no naval coöperation "can be relied on for the protection of our naval depots," because the navy will be engaged in attacking "the enemy's ports and destroying his commerce."

You will note then that the coöperation of the army which can be properly asked for by way of works and garrisons, should in every case have to do—as the Royal Commission of 1789 had to do—with a named amount of the enemy's force, and a named time within which he might operate before naval relief arrived.

But you will note that though the question of time enters into the conception of coöperative defense so far as outlying territories go, it does not enter in this way into the defense of the United Kingdom. It is only the most important of the enemy's naval forces that can threaten the United Kingdom, and they must be watched by the most important of our forces. Should there be evasion here, the rendezvous of the evaded fleets will be the United Kingdom, and no time lapses.

But we may perhaps sum up the two conceptions by saying that in the first there is a belief in the capacity of outlying and isolated territories to hold out indefinitely against assault and investment; and no over-mastering desire to keep touch with the enemy wherever he may be. In the second the incapacity of isolated territories to hold out without naval coöperation is recognized; but it is claimed that the surest

way to afford that coöperation is to prevent attack by the close observation of the only forces of the enemy which could attack.

THE JUDGMENT OF HISTORY UPON THE TWO CONCEPTIONS.

It happens that while history does not offer us any examples of the first conception thrown into a complete form, she does offer us two examples of the latter conception, one of which was absolutely complete, and the other all but absolutely complete.

In the Crimean War all the naval forces of the Russians were so observed by the naval forces of France and England that there never was a thought of the military defense of any part of the empire, nor ever even a thought about the subsidiary protection of our commerce, which was kept absolutely free by the action of the same observing fleets.

In the Franco-German War, the observation set up by the French upon the German fleet rendered the whole of the French outlying territories absolutely secure, and all but wholly protected French commerce. There was but one breach in the continuity. A single German cruiser escaped and made captures of French merchant ships off the mouth of the Gironde. But she was immediately pursued by French cruisers into a neutral harbor, and kept harmless there by observing ships until the end of the war. There was only one other purely naval episode in this war; a French and a German cruiser lay watching one another, and therefore rendering one another harmless, in a neutral port in the West Indies. Tired of this process, by mutual agreement they put to sea and fought a battle which turned out a drawn one because of the vicinity of neutral waters. But these two vessels also remained observing and neutralizing one another till the end of the war.

Though there is no example in history of a supreme navy acting in the manner supposed in the first conception of naval war; history gives us a very clear notion of how the inferior naval force acts when it has numerous outlying territories to defend, and insufficient naval forces to offer complete coöperation.

The period which offers the most perfect example is that from 1779 to 1783, when our American colonies were in revolt, when we had to endeavor to prevent succor coming to them from over sea, and when we had Gibraltar and Minorca to defend and hold in the Mediterranean, besides a great many islands in the West Indies and many ports in the East Indies. The whole of the forces of France, Spain and Holland were for much of this time arrayed against us, and we never had sufficient naval forces to observe them all. The result was the nearest approach we have ever seen to naval warfare according to the first conception; yet, as we shall see, the results were as far as possible from supporting the ideas it embodies; falsifying in every particular the denial of coöperation between the navy and the army, and showing that when it failed, it did so by *force majeure*.

The opening scene, though not the first act of the war, was the

appearance of the Franco-Spanish fleet of 66 sail of the line off Plymouth, watched by all the force we were able to collect for the purpose, 37 sail of the line under Sir Charles Hardy. The object aimed at was a descent upon our coasts, for which a French army was prepared; but the most that the fleet effected was to anchor a few frigates in Cawsand Bay and to capture a few coasting vessels. The greatest loss to us was that of the line-of-battle ship *Ardent*, which ran into the middle of the enemy's fleet, mistaking it for that of Sir Charles Hardy. Then the great fleet disappeared as suddenly as it had come.

A further act of audacity, following indeed upon many depredations upon shipping, was the threat of Paul Jones against some of the north-east coast ports. He appeared off Scarborough with one heavy and two light frigates. He was met by a British force of one less powerful frigate, and one light ship. In the ensuing battle the British ships were captured, but only after inflicting such damage on Paul Jones as to put an end to his threatenings, which were never renewed.

In the year 1690 de Tourville had pointed out to the French king, and Lord Torrington had pointed out to the English queen, the existence of a law in naval warfare. Their language was different, that of de Tourville being more definite, but their meaning was clear, and the same in both cases. It was a very simple and obvious law, and it was illustrated in the above cases. It was that an attack on territory cannot be made by a fleet in the presence of an observing and defending fleet, unless the attacking fleet is large enough to divide itself into two parts, one to neutralize the action of the observing fleet, and the other to support and cover the landing.

Many minor causes contributed at the moment to clear the Channel of the intact Franco-Spanish fleet; but there was nothing to prevent the ultimate transfer of the French army to its designed landing in the Isle of Wight but Sir Charles Hardy's 37 sail. Had the French and Spaniards a sufficient force to neutralize the action of this fleet, and to cover and support the landing on the Isle of Wight at the same time? Opinions may differ, but the facts remain.

Then with regard to Paul Jones, had he force enough to go on with his threatenings and ward off the attack of the inferior naval force at the same time? Clearly he had not. He was able to swallow up the whole of it, but he could do no more. So perhaps might the Franco-Spanish fleet have been able to swallow up Sir Charles Hardy, but they could not hope to have been in a position to go on with an invasion afterwards.

This principle, which forms the unseen part of naval coöperation with the army in defense of territory, runs all through the campaigns we are considering, and constantly governs them.

The United Kingdom was henceforth so free from alarm during this war that thrice we were able to denude it of all visible naval defense for two months at a time, in order to coöperate with the army in preserving

to our flag a most important isolated port that was chiefly a naval depot.

The United Kingdom being secure, the object of the campaign and the interest of the campaign passes away to the outlying territories in the Mediterranean, in the West Indies, in Africa, and in the East Indies.

In the Mediterranean were the two strongest maritime fortresses in the world, Gibraltar, and Fort St. Philip in Minorca. Both proved themselves in this war too strong to be carried by assault. The garrison of Gibraltar varied from 5000 to 7000 men; that of Fort St. Philip was 2700 men, about half what was required to man the works fully.

Gibraltar was early invested, and presently the army operating against it was numbered by tens of thousands. The investing fleet was sufficiently numerous and watchful to raise the price of turkeys to £3 12s. Neither garrison nor works availed against famine; so the navy, powerless to keep the waters round the United Kingdom and Gibraltar free at the same time, sent 15 sail of the line at the end of 1779 with an immense convoy, and reinforcements, to enable Gibraltar to hold out. In the beginning of 1781 the navy sent out the Channel fleet again with an immense convoy and reinforcements, and again enabled Gibraltar to hold out. Yet a third time the navy sent out its whole available force of 34 sail of the line to throw provisions, supplies, and men into the fortress. so enabling it to hold out to the end of the war. This last time, the fleet that was investing Gibraltar was 44 sail of the line, so nothing short of our whole naval strength would have sufficed to make successful coöperation. If in those days the navy had said to the army: "The services of our fleets are required for the protection of our commercial ports, of our commerce and shipping, and above all for the attack of the enemy's ports and the destruction of his commerce, none can be relied on for the protection of Gibraltar," where would Gibraltar be now? Clearly the army would have been asked to perform impossibilities. It was coöperation alone that saved the naval depots.

Minorca was not at first invested, and later the investment by sea was incomplete, so it was not early thrown into great straits. In any case, detachments with convoys went to it from the great Gibraltar fleets in 1780 and 1781. But in August, 1781, the enemy landed 16,000 men on the island, with 145 pieces of heavy ordnance, all of which proved futile against the immense works of Fort St. Philip. Yet though ordinary supplies, thanks to the convoy of April, 1781, and the incompleteness of the investment by sea, were not wanting, a garrison shut up in the confined space of a regular fortress was bound to fail in the absence of further naval coöperation. The place was proof against assault; it was proof for the time against famine; it was not proof against disease. The enemy landed in August, 1781, and in February, 1782, the place capitulated in the absence of naval coöperation. Gibraltar had the advantage of space for the garrison to keep itself in health, and it wanted little more than supplies. Fort St. Philip, if it was to hold out, required either the landing of a military force great enough to turn out

the invading army, or else a fresh garrison, and fresh supplies. It fell because this form of coöperation was not available.

In my paper on the coöperation of the army and navy in attack, I endeavored to show the conditions which admitted of attack, and then the nature of the attack. Gibraltar is perhaps the only fortress of importance in the world that does not admit of the sort of attack to which Fort St. Philip succumbed. Otherwise the attack on Minorca is typical of the general conditions and plan. These are reasonable security against interference by sea; then the landing of a land force enormously larger than the garrison, at points as far as possible away from batteries; and then simple investment of the works by sea, and their attack by land. These rules governed the conduct of the war during the period under notice.

So far as defense by the army is concerned, we note that the garrison of Fort St. Philip was only able to half man the works. The fact did not in this case affect the result, as disease would only have doubled its ravages in a doubled garrison. But it was the usual rule. Extended works; any number of guns; no men to man them. From my point of view we continue to act on the old fallacious conception; building and arming our works not in reference to the garrison we propose to hold them, but as if unmanned guns and deserted works were in themselves a defense.

Yet one more point. We see that the enemy did not attack Minorca until he could land a force about six times as large as the garrison. This general rule is as much as to say that generals will not undertake to conduct attacks except upon those terms, while admirals will not cooperate in landing the forces unless reasonably secure against interference from sea.

But look at Minorca from this point of view. Suppose that it had been defended by much smaller works, manned by a much smaller garrison; but that the enemy had known that larger forces than the invaders were ready in England, and would sail to land and turn the foreign army out as soon as the news of its landing reached them. Would the foreign army ever have thought of landing?

And compare then and now. It then took a full month to send relief from England to Gibraltar, and a full six weeks to send it from England to Minorca. It now would take only three or four days to send relief to Gibraltar; and four or five days to send it to Minorca. Which is the secure system of defense, looked at by the light of experience? Large garrisons closed up in works which yet they are not able to fully man, but with no hopes of naval relief for a very long time; or small garrisons in small works, but with reasonable certainty that any force proposing to strike at them would be crushed by a superior force from England in eight or ten days? In the uncertain days of sailing ships, when adverse winds might double or treble the times calculated on, such a scheme of coöperative defense might have been impossible. But now,

when the length of voyages, even to very distant points, may be calculated by hours, is it so certain that a greater security may not be obtained by adopting such a plan?

We can pass now to the West Indies to see many repetitions of the security of small Gibraltars maintained, and the losses of Minorcas incurred, according to whether there was or was not coöperation between the services. In rare cases we shall see places held and saved by the army alone, but the exceptions really enforce the general rule.

We must run through the examples with great speed, for time presses on and the principles are already drawn out and can be daily applied.

The first attack was made by the British in September, 1778, on the little French islands of Miquelon and St. Pierre. No French warships were anywhere near; there were practically no garrisons, and the islands surrendered in half-an-hour to an overwhelming force of ships and men.

In the same month the French attacked the British island of Dominica. It possessed extensive works, mounting 164 guns, but its garrison had been allowed to fall to under 100 in number. The French, knowing that our naval force could not be in time to interfere, landed 2000 men from Martinique, and carried the island in eight hours. Admiral Barrington flew with his ships to the rescue the moment he heard of the attack, but it was all over long before he reached the island.

In December, 1778, the British, believing that no French fleet was near, proceeded to attack the island of St. Lucia with more than 5000 men, which had been detached from North America, supported by seven sail of the line and frigates. The troops were landed, and keeping communication with the fleet and transports, drove back the inferior French garrison. While the attack was proceeding, a French fleet of double the force of the British made its appearance from North America. Admiral Barrington at once secured his position by placing all the transports inside him, and by anchoring in a line where each flank was protected by batteries; so covering the rear of the invading army and guarding its supplies. The French fleet was unable to dislodge him, but it landed large land forces to assist the garrison. The invading force was, however, too strong; the French withdrew the supports, and the island surrendered in 27 days.

Had the British squadron been absent, or had the enemy been able to overcome it, the French would have landed in rear of the invading army, cutting its communications and capturing its supplies. The result could not have been doubtful.

Turning for a moment to Africa, we have to note that the French, sending a squadron and troops to Senegal, where there were no defending naval forces, easily made themselves masters of all the British forts there, which were, as usual, extensive and well armed, but feebly garrisoned. When the French squadron sailed away and an English one took its place, the forts were mostly recaptured; when this squadron

sailed away and a French one took its place, the matter was reversed again generally. But the island of Goree, which had always fallen whenever it was attacked, being now attempted by ships alone, they were beaten off. though only three guns could be brought to bear upon them.

In the West Indies, in 1780, there was a pause till June, chiefly due to the balance of the naval forces. Then we get a case where the requirements of commerce interfered with naval coöperation. The French and English fleets were about equal in force in June. It was necessary to protect the gathering of the great convoy of the homeward bound trade at St. Kitts, and as Admiral Byron could not divide his fleet, he was obliged to quit his watch on the French fleet at Martinique. The French determined to make a dash at the British island of St. Vincent as soon as his back was turned; under 500 men were detached, escorted by a small squadron. The garrison was numerically equal to the invaders, but it collapsed in two days because the invaders were joined by the native population, which was a thing they had calculated on.

In July the French fleet became greatly superior to the British, and had moreover been reinforced by troops from Europe. D'Estaing, the French admiral, took 6500 troops, escorted by 25 sail of the line, to attack Grenada, which had as usual extensive fortifications and 124 guns, but only 550 men to man them. The island fell in two days. Byron got news of the intended attack, and immediately started to the rescue with his inferior fleet of 17 sail of the line. It was all over before he got to the island, but he fought a drawn battle with the French fleet in spite of his inferiority.

There was a Spanish fortress at Omoa, in Honduras, which mounted 33 guns and was garrisoned by 380 men. The British attacked it on its sea face by four ships, and on its land face by a detachment about as numerous as the garrison; it was carried by escalade in two days.

In May, nearer home, a force of 2500 men threatened the island of Jersey, but the approach of British warships postponed the landing and the attempt was not then renewed.

In February, 1780, Charleston, garrisoned by 5900 colonists, was attacked by 7500 British troops, supported by six sail of the line and frigates. It had beaten off, on a former occasion, a purely naval attack; now, in the absence of relief, it fell in three months.

In March, 1780, the French fleet was so superior to ours that the latter was blockaded in Gros Islet Bay, St. Lucia, by the former. The French contemplated an attack on the island, but in the end found that they had not force enough to face the coöperating defense, and abandoned their design.

In January, 1781, occurred one of the rare cases in which forces landed were reëmbarked without making a conquest, though un-

threatened by interference from the sea. The British fleet, under Rodney, was for the time immensely superior to the French. Understanding that the works of St. Vincent had been much damaged by a recent hurricane, and that the garrison was weak, the admiral and the general agreed to make a dash at it with some 300 troops from St. Lucia, and the marines of the fleet. They landed and made a reconnaissance, but coming to the conclusion that they had not force enough to make the conquest, quietly reëmbarked.

Later, in February, news of the declaration of war with Holland arriving, the admiral left a sufficient fleet to mask the French fleet at Martinique. The general embarked from St. Lucia with a land force, and the rest of the fleet sailed for the Dutch island of St. Eustatius. It was in no state to resist any attack and surrendered at the first summons.

Immediately afterwards the Dutch settlements of Demerara, Esquibo, and St. Bartholomew surrendered to the commanders of the sea for the time, the former without summons and the latter on summons.

Admiral Hood remained observing and masking the French squadron at Martinique while these things were going on, but with a fleet latterly increased to 17 sail of the line, because of the expected arrival of the French Admiral de Grasse with a large fleet. That fleet arrived, and made up 26 sail of the line when joined by the 5 that Hood had been masking. This upset the balance and left the French superior in the West Indies.

De Grasse at once proceeded to profit by it in making an attack on St. Lucia in May. Rodney had expected it, and, in spite of his inferiority—he had but 20 sail, some of them crippled, to the enemy's 26—sent a message to say he was hastening to the island's succor with the troops brought away from St. Eustatius. The French landed their troops and advanced, but at a lucky moment four British warships arrived at another part of the island and at once landed their men to strengthen the garrison, which of course had heart put into them by the news of Rodney's approach. The result was that the French did not care to go on. They reëmbarked and left our flag flying as a consequence of the coöperation between the two services.

But the French had a larger job on hand, resulting from their sea superiority. The island of Tobago, well to the south, had a garrison of less than 500 men. De Grasse had already dispatched 2000 men towards it with an escorting squadron. He now followed with his whole fleet and the troops he had reëmbarked. He landed perhaps 5000 men on the island and captured it in nine days. Rodney had fallen back, in his inferiority, to Barbadoes, and there he heard of the danger of Tobago. He at once sent a small squadron with troops to its relief, not knowing that de Grasse was following up. When he

knew that, he put to sea himself without losing a moment, but the island had gone before he reached it, and he was not strong enough to give battle to de Grasse.

In November the French re-took St. Eustatius in a day, just as we had taken it, by surprise.

In March, Pensacola, a town and port on the mainland, east of New Orleans, which was garrisoned by a few British detachments, was attacked by a Spanish fleet and an army of more than 5500 men. It held out for 61 days and then fell, in the absence of naval relief.

In July a British expedition with a squadron and troops proposed to capture the Cape of Good Hope. The French navy got the start of us, and we could not face the coöperation of the French fleet and the Dutch garrison reinforced. The idea was abandoned.

In January, 1781, the island of Jersey was surprised by the sudden landing of an invading force of perhaps 700 men, the garrison of the island being then about 2000. This invading force was intended to have been equal to the garrison. The breach of rule in landing with an inferior force could only lead, as it did, to the surrender of the invaders.

In January, 1782, Trincomalee, garrisoned by about 440 Dutch troops, was attacked by the British fleet which landed 530 troops and the seamen and marines of the fleet. The place, in the absence of any relief from the sea, fell in seven days.

In the same month, St. Kitts, in the West Indies, with a garrison of 1200 British troops, was invaded by 8000 French troops supported by 31 to 33 sail of the line. Hood, in the British fleet had only 22 sail, but directly he heard, he embarked troops and flew to its relief. It was impossible to attack the French fleet, but Hood slipped in between this fleet and the shore, where it was impossible to attack him with advantage. The British troops he had brought with him were landed, but the French invaders were too strong. The reinforcements were reëmbarked and the island fell after a defense of five weeks.

Demerara and Esquibo now surrendered, without fighting, to the French, as masters of the sea.

In March, the Bahamas, with a garrison of 170 men, surrendered in one day to the attack of a Spanish fleet and invading army of 2700 men.

But in April Rodney's victory over de Grasse restoring British supremacy at sea in these waters, put an end to our losses of territory, and made it pretty certain that had the war gone on with the maintenance of that supremacy, we should have recovered all our lost ground, and swept the whole of the enemy's territories into our pockets.

In the East Indies, the French and English naval forces being nearly balanced, we lost Trincomalee again. Suffren, taking advantage of a situation which put him within 12 hours of Trincomalee when Hughes, his opponent, was supposed to be 14 days from it, prepared to attack. In any case, Suffren had 15 sail of the line to oppose Hughes' 12. The garrison of Trincomalee having only a battalion, Suffren attacked it with

2600 men besides his fleet, and carried it in four days. Hughes got earlier intelligence of what was in the wind than Suffren had thought possible, and like Byron at Grenada, and Rodney at Tobago, had flown to its relief. Like his two prototypes he was just too late, but he fought a drawn battle, as Byron had done, which meant nothing to the successful strategist.

We have now dealt with 31 cases of attack from over sea upon territories, either by ourselves or our enemies; that is, all the principal attacks of that kind which were made in the war of American Independence. We get 21 cases where, in the absence of naval coöperation, the places fell; 5 cases where naval coöperation saved the places; 3, the second attack on St. Vincent, the second attack on Jersey, and the third attack on Goree, where the garrisons alone proved able to save the places; and 2, those of the first attack on St. Lucia and the attack on St. Kitts, where naval coöperation failed to save them.

I think the common sense of the thing should lead us to anticipate these results. If it is designed to cross the sea to attack, the first thing to be thought of is a clear sea to cross. Then the attack will not proceed, but upon intelligence, presumed to be good, of the defense likely to be offered; and unless forces ample to overcome it can be carried over, the expedition will not sail. So the great question of all is the clearness of the sea. We note in the West Indies where the captures fell to the power that had, at the time, the predominant fleet, and where the attacks ceased when the fleets were balanced.

Garrisons alone, we see, can rarely defend a place; attacks only fail, when once developed, where the attacking power has miscalculated the strength of the garrison.

But where coöperation in defense between army and navy is to be expected, the attacking enemy has two calculations to make, namely, the force he will require to overcome the defense after he has landed, and the time that the coöperating navy will allow him to work in. Here again we must suppose that his calculations will be more often correct than incorrect, and that as at Grenada, Tobago, and Trincomalee the navy will fail to put in an appearance till it is just too late.

On the whole, therefore, the only real defense is that of a supreme navy, making it always certain to the mind of the would-be-attacker that the initial condition which will permit of his planning attacks is absent—that the sea is not clear for him to cross.

No doubt there generally have been, and generally will be, snap-shots taken in spite of conditions. But no sensible man will turn from the general conditions of safety to provide the impossible in the way of defense against snap-shots which can be but of minor consequence.

Why, then, did these alternate sweeps of conquest follow our arms, or those of the French and Spaniards, in the West Indies? Simply because neither side had naval force enough to maintain sea supremacy permanently there. It was not possible for us to uncover the United

Kingdom by transferring the naval force allotted for its security permanently to the West Indies, while France was free to send every ship she had away. We went as far as it was possible to go in relieving Gibraltar and Minorca by the flying visits of the home defense fleet; we only dared to do it, because it was quite certain that in the two months of the fleet's absence, France could not plan and carry out an invasion, for which it would be necessary to recall her fleets from across the Atlantic. *Force majeure* compelled us from time to time to leave our West India islands initially open to attack, and to trust for their security to the coöperation of our inferior fleet with the garrisons.

When, in later years, our superiority in naval force was great enough, we preserved the West India islands in the only way which is absolutely effective, namely, by observing all the forces of the enemy which might otherwise attack. But even then the defense was not as perfect as it was in the Crimean and in the Franco-German wars.

In 1805 Napoleon planned a great *coup* upon the West India islands, to be carried out by Villeneuve's fleet from Toulon, which Nelson was observing, and by Ganteaume's fleet from Brest, which Cornwallis was observing. Villeneuve hoped to have escaped Nelson's observation, and was preparing his attacks when Nelson renewed it in the West Indies, and drove him home with his orders uncarried out. Ganteaume never was able to escape the observation of Cornwallis, and the whole of the great West India scheme fell flat and disappeared from the programme.

But the history teaches us one thing for certain, namely, that whatever the navy may say about not being able to coöperate with the army in garrison, and whatever the army may say about so fortifying and garrisoning ports so as to "free the navy," both sayings are pure nonsense. The navy will have to spend its last breath in coöperating with the army, because if it does not, the whole of our outlying territories, one after another, will pass into the hands of the enemy.

A SKETCH OF A POLICY OF DEFENSE FOUNDED ON COÖPERATION.

Let me take the parts in order as set out in an early paragraph. First, as to protection of commerce. That on the high seas must be looked after by the navy alone, the army cannot help it. But it can help where otherwise commerce is most vulnerable, namely, in the vicinity of our ports. If you examine the accounts describing the capture of places, you will generally find that one or two war-ships, usually small ones, have been captured in the ports. These are ships that had been stationed, more or less permanently, to keep the ports open; to keep the enemy's cruisers at a distance, and to enable merchant ships to pass out, or to enter, without interference. If you read much naval history, you would constantly read of ships being chased under coast batteries, and being safe there. I see no reason to believe that either of these things will cease if we have war. Then the coast batteries, manned by the army, will support and shelter the localized commerce defenders, when

cruisers of the enemy stronger than they are themselves put in an appearance. So, also, will hunted merchant ships, or for that matter, hunted war-ships of inferior force, seek the shelter of well-placed coast batteries, trusting to the coöperation of the army to bring their guns to bear and drive off the pursuers.

For we can scarcely hope in war to set up again the conditions of 1854, when no enemy's ships whatever got to sea. Although I do not think, if we have sufficient naval force, we need fear the swarms of free commerce destroyers that roamed the seas even after Trafalgar, yet I look for a great deal of attack on our commerce; and the vicinity of ports, where merchant ships are thickest, will always offer the best field if it is not well defended.

Coming to the coöperative defense of outlying territories and ports, we may think of Malta for an example. We have seen that the officer whom I have quoted spoke of Malta as being the only naval depot properly defended. Malta has a garrison of say 10,500 men, and immense works. Whether these are within the power of the garrison to fully man I do not know. Malta might be struck at, as a valuable possession to wrest from us, or the enemy might simply desire to destroy the dockyard. And Malta, without naval coöperation in defense, is quite certain to succumb to either attack. If conquest is the object, it is the usual mere question of landing men enough. Probably France would not undertake it with less than 30,000 men and ten battle-ships, with cruisers and small craft. It would be quite impossible for the garrison to prevent the landing, perhaps at two or three points, under cover of the battle-ships' guns. Once landed, and the island and port invested by the ships, the fall of Malta would be a mere question of time. Now if Malta had only a garrison of 1000 men placed in a well stored and perfectly closed work on one of the inland heights covering the harbor and the dockyard, with all the other fortifications razed to the ground, the enemy would have to make himself master of that work before he could occupy the harbor, or proceed to destroy the dockyard. The enemy would scarcely attempt the place with less than 5000 men, and the time it would take him to complete the conquest might quite possibly be longer than that required to conquer the 10,500 with 30,000.

What then is the difference in the two systems of defense, Malta being in either case bound to fall in a given time? The large garrison and the extended works cause the enemy to employ 25,000 more men, but that is all the difference to him. To us the difference is that we are left with 9500 troops as a free moving army, and when the blow comes we only lose 1000 men instead of 10,500. But that is all the difference.

Still supposing no coöperation, let us imagine that destruction of the dockyard, not capture of the island, to be the object of the enemy. He would then proceed by way of bombardment. It must be understood that the last thing in the world that the enemy's warships would do, in the event of an attack for conquest, would be to put themselves under

the effective fire of the present batteries; and if they were only one-twentieth of their present power, it would be just the same. If no other reason existed, it would be a mistake to pit a gun mounted afloat against the same gun mounted on shore, when the one costs twenty or thirty times as much to mount as the other.

But if destruction of the dockyard by bombardment were intended, the ships might undertake that service. The apparent contradiction is thus explained. To make an effect upon the works, the ships must close with them, and offer easy targets to the land guns. To make an effect on a large target like the dockyard, the ships act at such a distance as to make it very difficult for the land guns to hit them. Sweaborg is an excellent case in point, as the batteries had not the least effect on the bombarding vessels.

I am not sure, but I think that Malta is not self-sustaining, and that simple investment by sea, without firing a gun, or landing a man, would in time compel its surrender.

Thus we see that Malta, without coöperation, is no more defended than any of those islands that so easily passed out of our hands more than a century ago.

With coöperation, what is the meaning of the immense garrison and the enormous works of Malta? Recollect what coöperation, if complete, involves. It prevents any attack on Malta if there was not a man in the garrison or a gun mounted. It is no use exclaiming against such a proposition, as this was actually the case in the Crimean War. Hence if we start with coöperation as a principle, all we have to guard against is a certain amount of imperfection. In arming and garrisoning Malta we have not, that I know of, at all considered co-operation to the extent of saying against what force, and for what time, it is intended to hold out. But I suppose it is fair to say that it is prepared to hold out against 30,000 men on land, and investment by sea, for a month. Of course the dockyard is not secured, because neither garrison nor works can prevent that being bombarded. Nothing but the navy can stop that.

Now suppose coöperation established, but with only an equal naval force at Gibraltar (say) to that at Toulon. It is fundamental that Toulon should be watched by an abundance of light swift ships, if the watching fleet is placed 700 miles off at Gibraltar. Malta is 600 miles from Toulon, and 980 miles from Gibraltar. Supposing Toulon to send an expedition to sea, the fleet at Gibraltar would get news of it in 48 hours or less, and could be at Malta in 136 hours after the expedition left Toulon, or 86 hours after it arrived at Malta. Why should we want Malta to hold out for a month when, with coöperation, we only propose to leave the enemy free for three-and-a-half days?

Then about the size of the garrison. Of course one would say at the outset that it compels Toulon to send out 30,000 troops, whereas if there were only 1000 men in garrison, Toulon need only send out 5000 men,

and 5000 men might be got out without notice, while 30,000 could not; but this is a very superficial view. As a fact, Toulon would be breaking all the rules of war to send an expedition at all to attack Malta when the naval force at Gibraltar was equal to its own; but if it did so break the rules it would be bound to send out its whole naval force to support the attack; otherwise it would leave the Gibraltar fleet free to swallow up the naval escort. It would be no more easy to evade the watch with a landing force of 5000 than with one of 30,000 men, when the whole fleet must go with it.

But suppose evasion under such circumstances possible, and that Gibraltar got no news from Toulon—which is to suppose something almost miraculous—then news would come by some passing steamer from Malta itself (say) three-and-a-half days after the enemy's appearance there. This would give him a week to prosecute his attack in before the arrival of the Gibraltar fleet to interfere with it.

The question is whether there is the smallest chance of Toulon thinking of attacking Malta under the conditions, if it had but a twentieth part of its present garrison and works? It is, of course, the same with bombardment. The whole Toulon fleet must cover it, and must be prepared to fight an equal force at the moment when it is least ready, in consequence of its expenditure of ammunition.

Argument on the other side may claim an inferior fleet at Gibraltar. But then Toulon will be watching Gibraltar and not Gibraltar watching Toulon. Malta will go, unless a coöperating navy from some more distant point than Gibraltar interferes. But such a condition makes Malta perfectly useless to us. The Canal is blocked. The British merchant ships caught in the Mediterranean have sought the shelter of neutral ports and will stay there, as the German merchant ships did in the Franco-German War; and not a merchant ship will clear for the Mediterranean from a British port, as was the case under like conditions in 1796. Malta would simply be invested by sea, to surrender presently in mere hopelessness. But if the enemy did attack Malta, he could land as many men as he liked without requiring a large naval escort for them.

But superficially, we are apt to assume a great effort from England to relieve Malta, supposing it to be so attacked. It is Gibraltar, however, that is then in danger, and the effort will be to relieve it, not Malta; just as in 1782 our effort was to relieve Gibraltar and let Minorca go.

Still it may be argued that we should make an effort great enough to relieve Gibraltar and Malta too. Is not this to suppose two opposite conditions, namely, that we have, and have not, sufficient naval force to cover the United Kingdom and to coöperate in protecting outlying territories at the same time. If we have sufficient naval force to keep at least a fleet equal to that of Toulon at Gibraltar without uncovering the United Kingdom, why did we leave Gibraltar to be invested by a superior force?

If we follow this argument up and chase it into its various hiding places, it leaves us in the clear belief that if naval coöperation is effective, large works and large garrisons are wasted; if naval coöperation is not effective, the large garrisons and the large works fall into the enemy's hands. For outlying territories, when the basis of defense is naval coöperation, without which there is no defense, there is required: (1) localized naval force to keep the ports open; (2) a garrison large enough to make reasonably sure that a force three or four times its size, with reasonable naval force in support, cannot put to sea unnoticed; (3) a closed work to enable the garrison to hold out for, say, twice the time it will take a relieving force to arrive from the naval rendezvous.

We pass now to consider briefly what the coöperative defense of the Unlted Kingdom means.

The primary element of that coöperation was named, as already pointed out, by de Tourville on the French side, and by Lord Torrington on the English side, in 1690. An admiral will not conduct an invading expedition when—unlike the conditions of outlying territories—the question of time does not arise, unless he has naval force enough to divide into two parts, one equal at least to the defending fleet in observation, and the other to cover and support the landing. De Tourville supposed that our English admiral would require 30 sail more than the French fleet to enable him to invade, and then he would send ten to cover the landing and with all the rest offer battle to the whole French force. Torrington thought that the French admiral, who happened to be the same de Tourville, had not force enough with 80 sail, to cover and support a landing, if he detached ships sufficient to mask his own fleet of 50 sail; the event did not prove him wrong.

So this covering of the United Kingdom with a naval force too large to be masked by a force which has also to cover and support a landing, has for centuries been our naval policy of coöperation. We could not forego it even to retain the revolting American colonies, important West Indian possessions, or Minorca. We only dared to risk it to save Gibraltar, when the great bulk of a possible invading fleet was on the other side of the Atlantic.

If this is true, where does the army coöperation come in? Both history and reason assure us that it does not come in until this naval coöperation fails. Even our alarmist writers of fiction are forced to admit the fact, and to get rid of the guarding fleet, now by a torpedo, now by a storm, and now by making our Government send the defending force away at the time when it is most wanted to stay.

If I do not mistake official utterances, the idea of coöperation, as far as the United Kingdom is concerned, is based on what Colonel Balfour so cleverly assumes, as "an intermediate stage of naval war." This is, when you come to examine it, a condition such that our fleet has not the power to stop 100,000 men landing, but has the power to stop 500,000; it further supposes an element of time coming in, as we have seen

it so constantly coming in in the case of outlying territories. Colonel Balfour is not clear about this, but any one reading him carefully will see that it is mixed up in his thoughts. Yet this pre-supposes that the navy will begin by breaking the first rule of its coöperation, and will take its fleet away just when its coöperation is most wanted.

The only conceivable "intermediate stage" in regard to the defense of the United Kingdom comes about if our navy was less ready, much less ready, than those of our enemies when war was declared. But it is evidently no use considering this point in a scheme of coöperative defense just now. The immediate putting to sea of every ship we have is the very root and basis of our naval policy, and we do the greater part of it merely for exercise annually. It is impossible reasonably to found a coöperative policy on the basis that the navy will not be ready.

But most of Colonel Balfour's hypothesis assumes that our navy is beaten at sea. Very well; it is either beaten into its ports, whence it cannot pass out until it has built and manned more ships, or else it is only part of it that is beaten and driven into port, the rest of it keeping the sea. Very good again; then this part either is, or is not, sufficient on de Tourville's and Torrington's rules to bar invasion. If it is sufficient, then naval coöperation is still perfect, and the army is not called upon at all. If it is not sufficient, it will be driven into port and held there; and then we come back to the condition perfectly illustrated in the pages of naval history, where the fleets must wait till they have built more ships and manned them before they can again put to sea. In other words, while the "intermediate stage" in war, as respects outlying territories, is that between the opening attack and the arrival of the relieving fleet, so the "intermediate stage" in war, as regards the United Kingdom, is the period when she is building more ships and manning them—that is, a period measured perhaps by years. For the United Kingdom there is no relieving fleet; by the only reasonable hypothesis all her capital ships, with single and rare exceptions, are concentrated at home, and all the enemy's capital ships are engaged in their defeat—if that is to be.

How can the army coöperate while the navy is building new ships and manning them? Only, it is plain, by providing a garrison so large as to put it beyond the power of the enemy to assemble an army sufficient to insure its conquest. Otherwise, with the navy driven into her ports, to stay there till she has built many more ships and manned them, there will be nothing to prevent invasion in enormous force, hundreds of thousands of men.

But it is clear that the days of the Dutch wars cannot recur. The whole of our battle fleet matched against the whole combined fleet of the enemy is not conceivable. There must be several fights, with considerable intervals of time, during which the trend of victory will trace itself and give the army ample time to prepare for the worst. We cannot, without examination, say what this time will be, but it must be months

before the navy can be so beaten as to allow thoughts of invasion to arise in the enemy's mind, and then it must be more months before the enemy's navy can be in a state to conduct an invasion.

The one thing certain is that if the enemy can invade at all, he cannot do it with a smaller force than that of the garrison; while, on the other hand, the only limit to the number of men he invades with, will be the number he has available. He can easily, as has been often said, seize one or more defensible points with his advanced guards, and then go on pouring his forces in streams into the country until he is ready to advance to conquest.

It is clear that for coöperation in the defense of the United Kingdom, comparatively small forces quickly ready are of no use at all. What is wanted are very large forces which can be gradually got ready should the time for their action approach, that is, with not less than six or eight months' warning.

I have spoken more than once of the defense of outlying territories by holding out the threat of their speedy recapture with sufficient troops, should they be taken by the enemy. The reduction of garrisons and their consolidation in the United Kingdom, or at suitable rendezvous abroad, in the form of flying columns immediately ready, allies itself remarkably as a plan of defense, with the swiftness and certainty of transport over sea by steam.

If it were possible to suppose isolated attacks upon our home ports—which is exceedingly difficult for any one who studies all the conditions—then the mobile columns in the United Kingdom might be expected to coöperate with the movable naval columns which would fly to their defense. But in this, and in the coöperation in defense of merchant ships already spoken of, the only sedentary forces which are called on by the principles of coöperation to be instantly ready, are the gunners required to man the guns mounted in coast batteries. It seems to me equally evident that this is work for a militia, not for regular forces. You cannot man a gun more efficiently than by a crew which is always working that gun and no other. It is not possible, therefore, to man batteries more satisfactorily than by the able bodied who live in the neighborhood and are constantly trained to man them and work the guns.

My paper is of great length, and time has not permitted me to do more than summarize a good deal of it. I may state in conclusion my fear lest the regular and mobile army may not in the end be able to free itself from the incubus of ideas of sedentary defense. I have pointed out how nearly thirty years ago the navy fell under that ban and took away from the mobile navy money to build up an immobile one. We have been able to entirely free ourselves from that error, and we now bend all our energies to increase and maintain our mobility.

But we had no vested interests in maintaining any other system, and we had the tremendous engine of the signatures of two lords and a secretary to deal with them if we had.

In the army—taking it as a whole—more than half its members have vested interests in sedentary defense, who, from their point of view, are justified in fighting for it. There is no such independent and soulless body as a Board of Admiralty to control their desires. If there is money going they are bound to get some of it, and by so much the mobile army suffers. There is nothing that I know of to prevent the mobile army from being gradually undermined by the perfectly legitimate but mistaken action of the sedentary army, except a constant and ever-increasing examination into the principles of coöperation.

DISCUSSION.

Lieutenant-Colonel M. H. G. GOLDIE, R. E. : The subject before us is such a large one that it is quite impossible to say anything with a general application ; but I should like to ask one question on a point upon which I am not quite clear. As I understand it, this is a lecture upon coöperation in defense pure and simple, and I should like to ask the lecturer whether it is possible to disconnect entirely in our minds the two subjects of coöperation in defense and coöperation in attack. I may have misunderstood, perhaps, but I gather that a system of coöperation in defense depends to a certain extent upon the supposition that all the ships of the enemy are watched, and we have sufficient naval force to do that, and that all the attack we should have to fear would be by the enemy's ships which may have escaped. I should like to ask, supposing we have just the amount of vessels to do this watching and no more, whether the question of attack upon the enemy is entirely precluded, and if so how we should be able to compel him to sue for peace. If we are strictly on the defensive, with only sufficient ships to watch the enemy, how are we to bring our war to a successful conclusion?

Lieutenant-Colonel H. R. MENDS, K. R. R. C. : The lecturer said, "what is wanted are very large forces which can be gradually got ready should the time for their action approach, that is with not less than six or eight months' warning." I think a good many of us must have been struck by the expression "six or eight months' warning," and would like to know what grounds there are for believing that warning will be given. So far as wars now-a-days are concerned they begin suddenly, and a warning of six or eight months, which is apparently counted on, might not be given. Again, the lecturer speaks of sedentary defense, and implies that the money which is going to be expended on the army, and of which the officers who are interested in sedentary defense are likely to get a large share, would be used for forces which could not be employed for attack on the enemy's shores. As regards the auxiliary forces, which I presume are meant, possibly in the reconstruction of the army, they might be established more on the lines of the Swiss forces, which are available in something less than six or eight months, and in the event of a great war or national danger, they could then be used for crossing the sea and attacking the enemy on their own shores. In the same way as the German territorial army crossed the French frontier in 1870 on the principle that the best form of defense is the attack.

Major E. S. MAY, R. H. A. : I did not intend to have spoken this evening, but one statement of Admiral Colomb's in his extremely interesting and instructive lecture has so much surprised me, that I should like some explanation

of it; I allude to what fell from him when he spoke of leaving Malta to the protection of only 1000 men in a small work. I should like him to consider the political aspect of the question, and what the Maltese might be expected to say to such an arrangement; I should imagine they would very much object to being left with so small a force to safeguard them! Even supposing that difficulty overcome, and the garrison reduced to the number mentioned, what is to prevent one or two of the enemy's ships, which I suppose Admiral Colomb will admit might escape the vigilance of our fleet—what is to prevent a small force, such as these ships might land, from ravaging the island, destroying its capital, and the food supply of its inhabitants. After all, although a thousand men in able hands might do a great deal, history has shown us that so small a force has occasionally been rushed, and may certainly be masked, and it is conceivable that Admiral Colomb's fleet might go back to Malta after a brief absence and find it in possession of the enemy. And as regards the value of small works, and garrisons in general, I think the lecturer has somewhat overshot the mark. Suppose in the defense of Gibraltar, to which he has referred, it had only been garrisoned by a small force; could that stronghold have held out three-and-a-half years, as it did? That defense is one of the most glorious episodes in our military history, but its lessons do not point to the advisability of largely reducing garrisons in such places. With regard to the last paragraph, in which Admiral Colomb spoke of the desire on the part of some to obtain a slice of the money voted for the army for expenditure on fortifications, I suppose he referred chiefly to the engineers. But the mania for building vast works is now exploded, and I very much doubt, after reading Sir George Clarke's book, whether any one would desire to spend nearly so much money upon them as has been spent in the past. As regards the manning of coast defense works the lecturer has suggested that this duty should devolve upon the militia. Well, we have no objection to hand them over to the militia but many of us would be still better pleased to give them to the navy. I do not know what Admiral Colomb thinks about that question, and I shall be curious to hear his opinion upon the point.

Admiral COLOMB: I am always very glad to lecture here, for I feel that I am freer to speak out exactly as I think, believing that my audience knows that however mistaken I may be I am doing my best for their service as well as my own. Colonel Goldie asks whether we can separate attack from defense. To answer this you must understand the ground I am taking. I say that as between the army and navy, and between the mobile army and the sedentary army, there is no sort of prearranged plan by which their quantities, and distribution, and arrangements, are governed. For years it has seemed to me excessively uneconomical and rather dangerous to go on without a plan. I am endeavoring to put before you a plan and principle upon which you can go to work and by the following of which you may prevent excrescences and waste of men and money. Perhaps you may see what I am driving at. In laying down principles one doesn't go into smaller details. You can and you must in any scheme of coöperation separate attack from defense. It is properly said, and in a sense it is correct, that true defense is to attack. That is right enough; but the point is that you cannot attack till you have made your defense secure. You cannot attack till your communications are all right. That is the case with the navy. If you had only exactly the number of forces possessed by the enemy—say the number of ships required to watch every ship of the enemy—then unquestiona-

bly your powers of attack would be stopped. You could not let any one ship free while you went to make an attack, because the ship you left free might do more mischief to you than you would do in your attack. But as you began to get the upper hand you would find your forces swelling, and by the time you had sealed up your enemy you would have the forces necessary to assume the aggressive. When you have sealed up and are watching all the naval forces that can attack you the escorts you will require for your land attack become small. A few cruisers would convoy 30,000 men, provided you know your forces are masking all the others. A few frigates to guard a flotilla was quite a common occurrence in naval war. I am sure all these questions are excessively difficult; I know how long it has taken me to get at the back of them, and I am sure they require a great amount of thinking out. Colonel Mends thought I was unduly extending things when I said that six or eight months might be allowed as warning before we could be invaded. What I meant was that this period might elapse as a warning for the army to develop itself before an invasion would be undertaken. If you take a general view of things just as they are you will understand what I mean. If we suppose one of the enemy's ships to free herself, the getting free of that ship would be the first warning to the army. If 10 or 12 of our ships were to be beaten by 10 or 12 of the enemy that would be another warning, and we should prick up our ears and go on; in any case the preparation to invade with any large number of men is a tremendous task. It must take months upon months, and we know that in the Crimean War it took three nations more than two months to prepare, and we had everything at our back and nothing to be afraid of. Then 56,000 men were landed; treble that and you treble the difficulties and the time, and as you examine the question the time does not grow shorter but longer and longer. Colonel Mends asked whether the forces used for the sedentary defense might be used for attack later on. I do not doubt it, they might be later; but what I want to put before you is if we can be invaded it will be by a force with which our present sedentary forces can hardly cope. I do not touch upon what use of your sedentary forces you can make, but upon the principle of coöperation. Your sedentary forces are not required to be immediately ready, and you had better increase the number of them rather than attempt to increase their readiness. Major May spoke of the political views which would influence the garrisoning of a place like Malta. I can only reply that when you have your principle laid down you may trim it; you say although you have 1000 men to garrison that place the political situation may require more. But so far as the rushing of small garrisons is concerned it is difficult, particularly where small garrisons are in enclosed works. In such a case nobody can do anything until the citadel is taken, and we have no better illustrations than in the West Indies.

Major MAY: Could not they in the case of Malta get at the dockyard?

Admiral COLOMB: No, because you cannot do your business under the guns of a fort. You could not take your ships into the port if there was a single 6-inch gun commanding it. A 12-pr. field piece has driven off a fleet from Charleston in the American Civil War. Admiral Murray-Aynesley was beside it, and told me the fleet had to go as it could not stand against it. Batteries are things of which ships have a holy horror, and they will not stand against guns on land. An attack upon the island of Goree was a case in point, for it was prevented absolutely by three guns. Now about Gibraltar holding out; of

course when you have greatly extended works you must extend the garrison or the works will be a weakness. That is, I believe, the case with Gibraltar. Gibraltar had at first a much smaller garrison, much smaller works, and it was held by the reliefs of a fleet with headquarters at Lisbon. That I think is sufficient answer to this question. But where you have enormous works you must have correspondingly large garrisons to man them. Major May is perfectly right, and I hope in speaking against the existence of large works that I may be allowed to say that it is quite easy to throw money away by the manning of them. As to militia manning the guns round our coasts, I am glad Major May agrees with me. To think that 9000 garrison gunners are distributed round our coasts, while the field batteries are short, is a trouble to me. As to naval garrisons, I think I have not quite made up my mind. My naval prejudices are against them, perhaps, but the arguments used by Sir John Colomb in its favor are remarkably strong. In his recent pamphlet he says we ought to begin with Hong Kong. I think if we once began we might relieve the army to a great extent and give it great support, but as the Admiralty would have to pay the expense it would cost less. The Admiralty would no longer be able to charge the army with an indefinite expense.

General H. R. H. the DUKE OF CONNAUGHT, K.G., K.C.B.: I have to thank Admiral Colomb for coming amongst us a fourth time and lecturing upon the interesting and important subject of coöperation between the services. This is, as Colonel Goldie says, a very large question, upon which different views exist. We have heard Admiral Colomb, and we have read papers by him which show the deep thought he has given to coöperation between the army and navy, both in defense and in attack. There is one important side to this question on which we are all agreed, namely, that each service should understand what are the strong and weak points of the other, and how they should combine to strengthen the weak ones and increase the strength of the strong ones for the good of the country. How they are to be combined depends upon the decision of what I may term the "Committee of Defense," as represented in the Cabinet, and also by the views held by War Ministers and the Commander-in-chief and the Secretary to the Admiralty. We all know that, unfortunately, there has been in some periods of our history little foolish jealousies and a little cold-shouldering, one side saying that this or that matter only concerned the other, and they must help themselves. I think we have risen above that, and that we now recognize that the two services, existing for the defense of the country, their object is to work together, and that the more they bend to each other the better it will be for the country. Colonel Mends, Colonel Goldie, and Major May have given us the advantage of their opinions on some points raised in this lecture, and they have opened up questions of interest. I think I understood Admiral Colomb at the end of his lecture to imply that sometimes the Inspector-General of Fortifications got rather more money than he ought in comparison to other parts of the army, such as the artillery, cavalry and infantry, and that he would rather see that he did not get so much and that the money should be spent more on the mobile part of the army. Of course that is a very important question; but I think we are rather tending that way. For instance, I think the number of troops now required for the defense of Gibraltar is less than it was; a great many outlying forts and casemates have been given up and the number of gunners has been reduced. With regard to militia artillery being available for manning our defenses, I may remark that when I

was in command at Portsmouth, with Portland included, most of the defenses were manned by militia artillery drawn from all parts of the kingdom. From Ireland, Scotland, and the southern coast of England they came there to be trained in the forts they are expected to man in time of war. I hope that principle will be extended more and more, and that our large garrison fortresses will be manned not only by militia artillery, but also I hope by volunteer artillery as well. Some of the latter are quite capable of manning the guns and their shooting is good. If this were brought about, it would leave the regular artillery for the outlying parts and also permit of transfers to the field artillery. As regards the question which has been raised as to the navy taking over some of the duties in outlying stations, I am afraid the Admiralty hates the idea, but it has struck me that the fine body of marine artillery which they have, if utilized for this purpose, might certainly relieve our garrison artillery of onerous duties in very unhealthy and disagreeable stations. (Laughter.) It is, however, no use having an opinion on that subject because it rests entirely with the great spending departments. It is for the War Office to decide how far they shall go in the defense, and for the Admiralty to say how far they will undertake it. I do not think the Admiralty at present are inclined to change their minds. St. Helena and Ascension are cases in point. In conclusion I have to thank Admiral Colomb for again coming amongst us. The presence of a naval officer at our Military Society we take as a great compliment.

RECENT EXPERIENCES IN MILITARY SURGERY AFTER THE BATTLE OF SANTIAGO.

By Lieut.-Col. N. SENN, M. D., U. S. V., Chief of Operating Staff with the Army in the Field.

(*From New York Medical Record.*)

WOUND INFECTION.—Military surgery differs in no essential respect from emergency surgery in civil practice. The surgeon in daily practice has learned long ago that every accidental wound must practically be regarded and treated as an infected wound. In this respect the military surgeon of to-day has the advantage over his colleague in civil practice in knowing that the small-calibre bullet inflicts wounds which *per se* are more often aseptic than septic. Our recent experience in Cuba has shown that the small jacketed bullet seldom carries with it into the tissues clothing or other infected substances. Most of the wounds of the soft tissues uncomplicated by visceral lesions, which in themselves would become a source of infection, healed by primary intention in a remarkably short time. If infection followed, it usually did so in the superficial portion of the wound in connection with the skin, and, what is more than suggestive, the wound of exit was more frequently affected than the wound of entrance. This can be readily explained from the larger size of the wound and more extensive laceration and tearing of the tissues. In many of the cases ideal

healing of the wound did not occur, owing to a subsequent superficial suppuration of the wound. The deep tissues were seldom implicated in such cases. I have reason to believe that some of the compound fractures which are now suppurating had such a source of infection; that is, the extension of a superficial infection to the seat of fracture.

Two weeks have elapsed since the battle of Santiago was fought and we are now in a position to inquire more critically into the manner in which the wounds became infected. The many failures in protecting the more serious wounds against infection are attributable to three principal causes: 1. Inadequate supply of first dressings. 2. Faulty application of first dressing. 3. Unnecessary change of dressing. The medical officers with the regiments and in the field hospitals were hampered in their work by an insufficiency of proper dressing-material. The rapidity with which the invasion was planned and executed, the difficulties encountered in transporting the hospital supplies to the front, and the unexpected large number of wounded readily explain the lack of dressing-material where it was most needed. Most of the dressings were too small and not sufficiently secured to keep them in place during the transportation of the wounded from the front to the field hospitals. As a rule, not enough attention was paid to the immobilization of the injured part, an important element in securing rest for the wound and in guarding against displacement of the dressings. It is a source of regret that plaster-of-Paris dressings were not more frequently employed in the treatment of gunshot fractures of the extremities.

Another palpable evil in causing infection was the too common practice of unnecessary change of dressing. The transfer of patients from one surgeon to another could not be avoided. Patients brought from the first dressing-station to the field hospital usually were subjected to a change of dressing, and, when a few days later they reached the general hospital at Siboney, they had to undergo the same ordeal, and often not only once, but whenever they came into the hands of another surgeon. Patients not thus treated were dissatisfied, as the laymen are still laboring under the erroneous impression that the oftener a wound is dressed the quicker it will heal.

It is difficult to eradicate such a deep-rooted and time-honored belief and patients will continue to clamor for a change of dressing, and the good-natured and hard-working surgeons only too often yield to the unreasonable requests. The evil of meddlesome surgery has become very apparent during our brief Cuban campaign and has taught us an important lesson that must be heeded in the future. Our military surgeons must learn to realize the value and importance of the first-aid dressing. In all cases in which the first examination does not reveal the existence of complications which require subsequent operative treatment, the diagnosis tag should convey this important instruction: "Dressing not to be touched unless symptoms demand it." Such instruction is significant and must be followed to the letter by all sur-

geons in subsequent charge of the patient. I am satisfied more than ever of the necessity of including in the first-aid dressing-package an antiseptic powder. For years I have used for this purpose a combination of boric acid and salicylic acid, 4 to 1, with the most satisfactory results. I am also partial to sterile absorbent cotton in place of gauze for this particular purpose, as it constitutes a more perfect filter than the loose gauze. A teaspoonful of the powder mentioned dusted on the wound forms with the blood that escapes and the overlying cotton a firm crust which seals the wound hermetically. Should the primary dressing become saturated with blood, the same powder should be dusted over the wet dressing and an additional compress of cotton be added to the dressing. After the first dressing has been applied it should not be moved, except for good and substantial reasons. Much can be done in the after-treatment in the way of readjusting the bandage and in immobilizing the injured part, but the first dressing must remain unless local or general symptoms set in which would warrant its removal. Malaria and yellow fever, that crept in upon us so insidiously, are responsible for many unnecessary changes of dressing. The appearance of fever in a wounded man naturally leads to the suspicion that there is something wrong in the wound. Many dressings were changed on this ground; nothing abnormal was found in the wounds, and a day or two later the nature of the fever was recognized and the patients were either given quinine or were sent to the yellow fever hospital, in accordance with the final diagnosis made. Every change of dressing, more especially in military practice, is attended by risk of infection, and must be scrupulously avoided unless local or general symptoms indicate the existence of complications which demand surgical intervention. In writing the above it is not my intention to cast any reflection on the work of our surgeons; on the contrary, I willingly bear witness to the ability, faithfulness, and unselfishness with which they have done their duty. A better and more conscientious group of medical officers it would be difficult to select anywhere. The results on the whole are excellent, but I am hopeful that they can be improved in the future by placing more stress upon the value and importance of the first dressing, and I wish to repeat again and in the most forcible way the language of the late Professor von Nussbaum: "The fate of the wounded rests in the hands of the one who applies the first dressing." If this be true in civil practice, its meaning cannot be misinterpreted in military surgery.

Effects of Bullets on the Soft Tissues.—In recent cases the small tubular wound made by the Mauser bullet was surrounded by a narrow zone of contused tissue and the wound space itself filled either with liquid or with coagulated blood. A few days later the wound itself was found surrounded by an area of suggillation which varied in extent according to the nature of the injured tissues and the amount of extravasation. In cases in which the bullet passed through the tissues some distance and not far from the surface of the skin, the location and direc-

tion of the wound canal were indicated by a discoloration of the skin a few days after the injury occurred. In a number of cases of aseptic wounds, in which the bullet had lodged in the tissues and was removed a week or ten days later, I had an opportunity to study the remote effect of the injury on the tissues. In all cases the swelling of the tissues at this time had nearly or entirely obliterated the tubular wound, the location of which was indicated by a dark discoloration, parenchymatous extravasation, remains of fluid or coagulated blood, and a limited area of œdema and infiltration. These conditions served as a useful guide in following the course of the bullet. The bullet itself was usually found loose in a small cavity filled with liquid blood or bloody serum, while a more extensive zone of infiltration indicated the early stage of encapsulation. I have no further doubt that the new bullet will become encapsulated and remain harmless in the tissues as readily or more so than the old-fashioned leaden bullet. In isolated cases late suppuration at the seat of the bullet resulted in the formation of a circumscribed abscess, a complication which aided the surgeon in locating, finding, and removing the missile. It was a surprise to us all to find that in more than ten per cent. of all the wounded the bullet was lodged in the tissues, a vastly greater number than we had any reason to expect. The cause for this became apparent when we began to study the condition of the bullets recovered. A large proportion of the bullets recovered were found deformed, showing that they were deflected bullets which had struck a hard object, or had passed through a resisting medium before they reached the object for which they were intended. The ground upon which the battle was fought is stony and covered with trees and thick underbrush, furnishing the most favorable conditions for deflection of the missiles. Some of the firing was done at a great distance, so that occasionally a spent ball was found in the soft tissues without injury of the bone. One of these bullets was a nickel-encased Mauser projectile, natural size, the jacket perfect, that was removed from the leg about four inches above the ankle-joint. It had entered the calf of the leg below the popliteal space and never touched the bone. I have another bullet of the same kind, the point of which is flattened and much rounded, which was removed from the head of the tibia. This bullet was probably fired from a great distance, and the deformity was produced by the bone. Another was a nickel-clad bullet very much deformed. It was found lodged in the deep tissues of the thigh, about two inches from the wound of entrance, slightly overlapping the femur near the middle of the shaft. The bullet evidently struck a stone behind its point and was deflected before it entered the tissues. It was much flattened and curved. The convex side and point of the bullet and jacket were perfect, the lead being exposed between the edges of the case.

The Value of the X-Ray in Military Practice.—The value of the probe as a diagnostic instrument in locating bullets has in modern military

service been almost entirely superseded by dissection and the employment of the X-ray. If from the nature of the injury and the symptoms presented the bullet is located in a part of the body readily and safely accessible to the knife, and it is deemed advisable and expedient to remove it, this can often be done more expeditiously and with a greater degree of certainty by enlarging the track made by the bullet than by relying on the probe in finding and on the forceps in extracting the bullet. If, as is often the case, the whereabouts of the bullet is not known, its presence and exact location can by the use of the *x*-ray be determined without any pain or any additional risks to the patient. All of the bullets removed on board the hospital ship *Relief* were located in this manner. Dr. Gray, an expert in skiagraphy, who has charge of the scientific work of the floating hospital, has been of the greatest service to the surgeons in enabling them to locate bullets and in guiding them as to the advisability of undertaking an operation for their removal. His large collection of skiagraph pictures will also furnish a flood of new light on the effect of the small-calibre bullet on the different bones of the body. Dr. Gray's work will constitute an essential and enduring cornerstone of a much-needed modern work on military surgery. The skiagraph has enabled us to diagnosticate the existence or absence of fractures in a number of doubtful cases in which we had to depend exclusively on this resource. In fractures in close proximity to large joints the X-ray has been of the greatest value in ascertaining whether or not the fracture extended into the joint. In one case of gunshot wound at the base of the thigh, in which the bullet passed in the direction of the trochanteric portion of the femur, opinions were at variance concerning the extent of injury to the bone; some of the surgeons made a diagnosis of fracture, while others contended that there was no fracture, but believed that the bullet had made a deep groove in the anterior portion of the bone and had possibly opened the capsule of the joint at the same time. The X-ray picture clearly demonstrated the absence of fracture and the existence of a deep furrow with numerous fragments on each side. The X-ray apparatus also proved of the greatest practical utility in showing the displacement of fragments in gunshot fractures of the long bones, and enabled the surgeons to resort to timely measures to prevent vicious union. The fluoroscope has greatly added to the practical value of skiagraphy. In the light of our recent experience the X-ray has become an indispensable diagnostic resource to the military surgeon in active service, and the suggestion that the chief surgeon of every army corps should be supplied with a portable apparatus and an expert to use it must be considered a timely and an urgent one.

The Wounded of the Battle of Santiago.—It will be of interest to the profession to know something definite of the nature of the wounds and of their more remote results on the victims of Spanish bullets in the battle of Santiago. Two weeks have passed away since the battle. A considerable number of the wounded have died since and many have left

for the United States on the *Olivette*, *Solace*, and transport ships. From among the one hundred and twenty-seven wounded now on the way to their homes on the hospital ship *Relief*, I have selected a number of cases of more than usual interest, for the purpose of studying the effects of the small-calibre bullet, immediate and remote, on the different organs and regions of the body. It is my intention to give the course of the bullets by marking on the diagrams accompanying the report of each case the wound of entrance and exit. A study of the diagrams will show that deflection of the bullet in the body is exceptional; as a rule, the wound canal was in a perfectly straight line from one wound to the other. By following the track of the bullet it is not difficult to determine the organ or organs implicated in the injury. I shall classify the cases so as to embrace gunshot wounds of, 1, the head; 2, the neck; 3, the spine; 4, the chest; 5, the abdomen; 6, the extremities.

Gunshot Wounds of the Head.—To my own knowledge a number of sufferers from gunshot wounds of the head who survived long enough to be transported to the general hospital at Siboney died within twelve days after the receipt of the injury. In all of the cases intracranial infection was the immediate cause of death. Encephalitis and leptomeningitis constituted the fatal complications. The beginning of the intracranial inflammation was always announced by cerebral hernia, which in size was proportionate to the extent and intensity of the inflammatory process. The surgical treatment resorted to in most cases proved powerless in limiting the infection. If these cases had been studied with a little more care during life and if post-mortem examinations had been made more frequently, valuable material could have been obtained for the advancement of the as yet imperfectly developed science of cerebral localization.

CASE I.—Fred. Shockley, Company D, Tenth Cavalry, wounded July 2d. When the injury was received the patient was lying on his abdomen with chest and head extended, at the base of the ridge occupied by the enemy, which position readily explains the unusual course of the bullet. The bullet struck the occipital bone at a tangent, producing a comminuting fracture with depression; it made a deep groove in the back of the neck and then entered the body on a level with the first rib to the left of the seventh cervical vertebra, passed through the chest, and escaped in front through the second intercostal space, a little to the left of the mammary line. Soon after the injury was received he coughed up a small quantity of blood; no hæmorrhage since or any indications of hæmothorax, pneumonia, or pleuritis. The chest wounds healed by primary intention. At first he had convulsions for a few moments; no loss of consciousness, but clonic spasms of both arms. At present intellect is unimpaired; has some headache and a sensation of throbbing in the head; some impairment of motion and sensation of right leg and complete loss of motion of toes of right foot. Had some pain in eyes and slight dimness of vision.

CASE II.—Patrick Ward, Company I, Third Cavalry, admitted from hospital of Siboney to hospital ship *Relief*, July 11th. Injury probably received in the same manner as in Case I. A large defect in the occipital bone marked the wound of entrance and exit in the skull; the opening was enlarged by operation. The linear wound between and extending as far as the last cervical vertebra was undoubtedly made in following and removing the bullet. A cerebral hernia projects from the opening, and a deep-seated cerebral abscess was recently discovered, opened, and drained. In part the hernia is covered by skin. Both parietal bones are the seat of a comminuted fracture. Mental faculties not impaired; no focal symptoms. The patient is losing strength rapidly and will soon succumb to the intracranial lesion.

CASE III.—James Russell, Company A, Thirteenth Infantry, was wounded July 1st. When he was brought on board the *Relief*, a cerebral hernia about the size of a hen's egg was found over the sagittal suture, an inch in front of the occipital protuberance. The opening was evidently the wound of entrance, and by operation has been connected with the wound of exit by a channel an inch in length and half as wide. The hernia occupied the wound of exit. A number of loose fragments of bone have been removed at different times. There is marked hemiplegia on the left side; the forearm is strongly flexed and in clost contact with the chest. Sensation not diminished; speech clear but ideas confused; pupils react to light; incontinence of urine; extensive decubitus over sacrum; temperature, 100.5° F.; pulse and respiration normal.

CASE IV.—B. C. Parker, Company C, Fourth Infantry, was wounded July 1st. The bullet entered the left temporal region, comminuting the bone in that region extensively, and escaped over the left frontal eminence. The cranial defect was increased by the removal of a number of loose fragments. There has been quite a profuse sero-purulent discharge from the wound. The only focal symptom consists of a prickling sensation of the right foot or chest when the wound is being dressed. Mind clear most of the time; occasionally slight confusion and wandering. The absence of cerebral hernia in this case is the surest indication that the infection is local.

Gunshot Wounds of the Neck.—CASE V.—Lieut. Albert Scott, Company C, Thirteenth Infantry, on July 1st, while standing with his company at the foot of a hill during the advance on Santiago, received a wound in the neck. The bullet entered the neck on the right side, just below the inferior maxillary bone, an inch in front of the angle of the jaw. The wound of entrance is a clean-cut hole about the size of a lead pencil. The course of the bullet was backward and slightly downward, emerging at the back of the neck on a level with and to the left of the fifth cervical vertebra. At the moment the injury was inflicted he felt no pain in the wound, but he experienced a sensation as if he had been grasped by the wrists and thrown

violently to the ground. The wound of exit is of the same size and appearance as the wound of entrance; very slight hæmorrhage. A few minutes after receiving the injury he was carried from the firing line by members of his company and was soon transported to the First Division hospital, where he remained for ten days, after which he was removed in an ambulance to the hospital at Siboney, a distance of seven miles over a very rough road, and a day later was transferred to the *Relief*. He first became aware of the existence of the wound on the way from the field to the hospital. At the time he came on board the hospital ship he was voiceless and made constant efforts to clear the bronchial tubes of mucus. Complete paralysis of right arm and leg and partial loss of power in left arm and leg; respiration normal but an almost constant spasmodic cough; no control over sphincters; involuntary passages from both bladder and bowels; great debility and profuse sweating. Complains of pain all over the body. Morphine and atropine to subdue pain. A radiograph taken by Dr. Gray shows an injury of one of the cervical vertebræ, probably the fifth. Injury seems to be to the left of the body of the bone. Has received no treatment other than complete rest and a nightly anodyne as noted above, which secures a good night's sleep and markedly diminishes the sweating. Has regained control of the sphincters and is able to use bed-pan and urinal. July 19th—during the past six days there has been a decided improvement in the general condition of the patient. He is bright in appearance; he can articulate more distinctly and there is a decided return of power in the right leg. The right hand is still absolutely powerless, but the grip of the left hand is decidedly stronger. Appetite and circulation good. July 21st, improvement in general condition still continues. The external wound healed by primary intention and the scar can be seen only by making a careful inspection. Trional and sulphonal have been substituted for the morphine.

CASE VI.—Oscar C. Buck, Company F, Second Infantry, was shot by a sharpshooter hiding in a tree, July 1st. The bullet passed through the neck, from side to side. The first and only evidence that the patient had that he was injured was bleeding from the throat; the hæmorrhage at first was quite profuse. Stiffness of the neck and pain on movement have been the only symptoms complained of since. The bullet entered over the sterno-cleido-mastoid muscle on the left side, about two and a half inches from the mastoid process. The wound of entrance was circular and very small; the wound of exit on the same level and about half an inch nearer the spine. Three days later a small superficial abscess formed in the wound of exit, which was evacuated by dilating the wound. Both wounds were perfectly healed July 20th. Judging from the course of the bullet, it is difficult to understand how the principal nerves and large vessels of the neck escaped injury. This is one of those cases that require careful watching, as a traumatic aneurism may de-

velop in the event the bullet injured the external tunics of either carotid artery.

CASE VII.—Charles F. Flickinger, Company C, Fourth Infantry, was wounded July 1st, while lying down. The bullet entered the left posterior cervical triangle on a level with the spinous process of the fifth cervical vertebra, midway between the spine and the posterior border of the sterno-cleido-mastoid muscle, and emerged opposite the spinous process of the seventh dorsal vertebra, and equidistant from that point and the posterior border of the scapula. The patient complains of severe pains in the shoulders on attempting to move, but is free from any symptoms that would indicate any injury to the spinal cord. He was within one hundred yards of the enemy when he was wounded.

Gunshot Wounds of the Spine.—All who received gunshot wounds of the spine in which the cord was seriously damaged have died or will die in the near future. The immediate cause of death in such cases is either a septic leptomeningitis or sepsis and exhaustion from decubitus. Death from the first-named cause takes place early, as the result of infection of the wound and extension of the inflammation at the seat of the visceral injury along the meninges and surface of the spinal cord. The first case of this kind I saw at El Caney, a few days after the battle of Santiago. The patient was a Spanish prisoner. I found him lying on the bare stone floor of the village church. The bullet had entered over the centre of the spine at the junction of the dorsal with the lumbar vertebræ, its course apparently being directly forward. Complete paraplegia below the seat of injury. Bladder distended, reaching nearly the level of the umbilicus; incontinence of urine. The neck, trunk, above the wound, and upper extremities rigid; fever; pulse rapid and small; countenance extremely pale. The wound was protected by a small, dirty dressing, and was suppurating. I doubt not the patient died in less than twenty-four hours after I saw him. Wounds of the spine without injury to the cord frequently gave rise to temporary paralysis, varying greatly in degree and duration.

CASE VIII.—George Kelly, Company C, Seventeenth Infantry, was shot July 1st, while lying in a prone position. The bullet, which was fired from a block-house on the summit of a hill, at a distance of about six hundred yards, entered the body at a point a little below and at the middle of the right ilium, and emerged from the opposite side about three inches below the crest of the ilium. The patient asserts that he suffered intense pain immediately after he was shot, and that he is now free from pain except when he attempts to walk. The pain thus caused he refers to the sacro coccygeal articulation. The wounds are healed, and the absence of paralysis is the best evidence that the contents of the spinal cord escaped injury, although the bullet must have passed transversely through the first sacral vertebra.

CASE IX.—John Robinson, Company C, Twenty-fourth Infantry. The bullet entered the supraspinous fossa of the left scapula and escaped

from the right lumbar region, having perforated in its long course the lung, spinal cord, diaphragm, and liver. Wounds healed in ten days. Expectoration bloody. Complete paraplegia. Beginning extensive decubitus over sacrum and spinous processes.

CASE X.—Otto Derr, Company A, Twenty-first Infantry, was wounded July 2d. Bullet passed through the chest from side to side, from the postaxillary line on the right side to a corresponding point on the opposite side on a level with the seventh intercostal space. Complete paralysis of motion and sensation below the seat of spinal injury. The wound healed, but life was threatened at the time from a commencing septic decubitus.

CASE XI.—Lewis M. Carlisle, Company K, Seventy-first New York Volunteers, was hit by a shrapnel in the back on a level with the third lumbar vertebra, the spinous and left lateral processes of the same being shattered. The missile was removed as soon as the patient reached the division hospital. As profuse suppuration set in and continued, the patient was anæsthetized on the 18th and a number of fragments of bone were removed. A large abscess cavity in the right lumbar region communicated with the wound. The cavity was drained by making a counter-opening in line with Simon's incision. Impaired sensation in the right leg was the most important focal symptom in this case.

CASE XII.—Charles J. Reardon, Company C, Sixteenth Infantry, was wounded by a fragment of shrapnel which struck him as he lay on his back with his shoulders raised, ready to fire. The wound was directly over the spine, on a level with the fourth dorsal vertebra; the missile evidently opened the spinal canal and injured its contents. The foreign body remains embedded in the tissues; its location so far has not been determined. Paraplegia is complete below the level of the umbilicus. On the 18th the patient was still alive, but an extensive moist decubitus will become the direct cause of death in the course of a few days.

Gunshot Wounds of the Chest.—It is well known that during the War of the Rebellion men had a better chance for life when the bullet passed through the chest than when the chest was opened and the ball remained. The same remains true now, although not to the same extent, as the small-calibre bullet is less likely to carry with it into the chest clothing or other infectious material. The number of those with chest wounds who have lived long enough to reach the hospital on the coast is astonishing, and, what is still more surprising, is the fact that unless the hæmorrhage was severe the symptoms were mild, some of the patients being confined to bed only for a few days. All of these cases were treated on the expectant plan—that is, by dressing the external wound or wounds; in no instance was the pleural cavity opened for the purpose of arresting the hæmorrhage.

CASE XIII.—William A. Cooper, Company A, Tenth Cavalry, was wounded July 1st. The bullet entered an inch below the left nipple and escaped from the body an inch below the costal arch in the mammery

line. It is questionable whether the bullet opened either the pleural or the peritoneal cavity, as the injury was not followed by any symptoms referable to visceral wounds of the chest or abdomen, although the course of the bullet was such as to give rise to the suspicion that either or both of these cavities might have been invaded.

CASE XIV.—Edward O'Flaherty, Company C, Sixteenth Infantry, was wounded, July 2d, by a ball, forty-five calibre, from a bursting shrapnel. The projectile entered below the angle of the right scapula, passed through the lung, diaphragm, liver, and lodged beneath the skin in front between the seventh and eighth ribs. Bloody expectorations for some time and slight elevation of temperature. July 12th, temperature normal. July 21st, patient suffers but little inconvenience from his wound. No peritoneal or pleural effusion. General condition promises an early and complete recovery.

CASE XV.—John B. Senica, Company G, Twenty-second Infantry, was wounded, July 1st, by a bullet which entered his back just below the angle of the left scapula, passed upward through the lung, neck, and jaw, and emerged through the alveolar process of the right bicuspid tooth, cutting the tongue slightly. All the wounds healed in a short time by primary intention. Hæmoptysis profuse immediately after he was shot, and slight for the following few days. Left arm at first nearly powerless, with desquamation of the skin of the hand. Function of the arm returning gradually. In three weeks the patient was able to sit up for a short time each day. Physical examination of the chest at this time revealed nothing abnormal.

CASE XVI.—Winslow Clark, Company G, First Volunteer Cavalry, was wounded, July 1st, by a bullet which entered the chest after perforating the left scapula through the infraspinous fossa, three inches above the angle and an inch from the spinal border. No wound of exit. The probable course of the bullet was downward and forward. Some hæmoptysis and fever. No vomiting of blood. The hæmothorax was quite extensive, and was relieved by tapping a week after the injury. He is now (July 22d) convalescing rapidly.

CASE XVII.—Arthur Fairbrother, Company C, Third Cavalry, sustained a perforating gunshot wound of the chest, July 1st. The bullet entered the chest just below the middle of the right clavicle. No wound of exit. Hæmoptysis rather profuse, followed by hæmothorax. Has had fever off and on, probably malarial. Patient was admitted to the *Relief*, July 15th. Wound not completely closed. On coughing, dark fluid blood escapes. Nearly the entire pleural cavity filled with blood. Two days later three pints of dark fluid blood were removed by tapping and siphonage. Sputum at this time still bloody. July 22d, patient much improved. No signs of empyema. Hæmothorax diminished, but may require a second tapping.

CASE XVIII.—Scanlon, Company K, Third Cavalry, was wounded on the second day of the battle of Santiago. The ball entered the chest

through the third rib, midclavicular line, on the right side, passed downward and backward, and escaped in the gluteal region on the same side, after perforating the ilium. The ball must have passed through the lung, diaphragm, and liver. Hæmoptysis slight, but distressing nausea, vomiting, and pain. Admitted to the hospital ship *Relief*, July 15th. At that time he had a temperature ranging between 100°–102° F., vomiting, diarrhœa, and rapid emaciation. Great pain over the liver and along the ascending colon. Hæmothorax and marked swelling in the region of the liver and abdominal cavity on the right side. Examination of the urine negative. Owing to the great debility and pronounced anæmia, it was not deemed advisable to resort to laparotomy.

CASE XIX.—Henry Mitchell, Company C, Seventh Infantry, was wounded July 1st. The bullet entered over the right acromion process, passed through the apices of both lungs, and escaped through the second intercostal space above the right nipple. No hæmoptysis at any time, dry cough, and a moderate hæmothorax on the right side. Has suffered from quotidian form of malarial fever, which is yielding to quinine. A speedy and complete recovery is expected.

CASE XX.—Lieut. John Robertson, Company G, Sixth Infantry, received a gunshot wound of the upper third of the right thigh at about 3 o'clock July 1st. The profuse hæmorrhage was partly controlled by an improvised tourniquet applied by an officer of the line. He was carried to the rear by men of his company, and while thus conveyed he was shot in the left breast, the bullet entering just below the left nipple and passing through the chest in an antero-posterior direction. He was wounded a third time, the bullet grazing the inner side of the left knee. The first dressing was applied in the first division hospital. The fracture of the thigh was dressed by the use of a long splint. From here he was sent, on the 9th of July, to the third division hospital, and two days later was brought on board the *Relief*. At this time both chest wounds were healed. The thigh wounds remained aseptic. A radiograph showed great displacement of the fragments by overlapping. The fracture was then treated by confining the limb upon a double inclined plane, consisting of a hollow posterior splint made of the sheath of the leaf of the cocoa palm, to which was added an anterior thigh splint of wire gauze. After being dressed the limb was suspended in a sling. No pulmonary or pleuritic complications.

CASE XXI.—Henry T. Darby, Company D, Thirteenth Infantry, received a perforating gunshot wound of the chest, July 1st. The ball entered on the right side above the angle and at the outer border of the right scapula, passed through the chest, and escaped through the fourth intercostal space in front on the opposite side, two inches outside of the mammary line. When the patient came on board the *Relief*, July 9th, he complained of great difficulty of breathing; he was pale and greatly prostrated; temperature, 102° F. The physical signs indicated the presence of a copious pleuritic effusion on the left side. The chest was

opened by an incision through the sixth intercostal space in the axillary line, July 11th. About three pints of fluid blood escaped. Gauze drainage. The lung expanded rapidly and the patient commenced to improve.

No further doubt remains in regard to the difference in the mortality of gunshot wounds inflicted with the large and the small calibre bullets. The cases related above appear to prove that the danger incident to gunshot wounds of the chest made by the small projectiles consists in complicating injuries involving the heart and large blood-vessels, and that in the absence of such injuries the progress is favorable. It seems that empyema is a rare remote result of such injuries. Rib resection and free incision and drainage of the chest must be reserved for cases in which a positive diagnosis of empyema can be made. The safest and best treatment for hæmothorax requiring operative interference is tapping and evacuation by siphonage.

Gunshot Wounds of the Abdomen.—Our recent experience in Cuba has more than ever confirmed my convictions that not infrequently cases of penetrating gunshot wounds of the abdomen will recover without active surgical interference. For years I have maintained, as the result of clinical experience and experiments on the cadaver, that a bullet may pass through the abdomen on a level with and above the umbilicus in an antero-posterior direction without producing visceral injuries demanding operative intervention. Elsewhere the results of my experience and experimentation concerning such injuries have been published. If the bullet traverses the small-intestine area, it is more than probable that from one to fourteen perforations will be found. Four laparotomies for perforating gunshot wounds of the abdomen were performed at the first division hospital, the only cases to my knowledge during the Cuban campaign. All of the patients died. This unfavorable experience should not deter surgeons from performing the operation in the future in cases in which from the course taken it is reasonable to assume that the bullet has made visceral injuries which would be sure to destroy life without surgical interference. In other cases the employment of diagnostic tests for the purpose of determining the existence or absence of intestinal perforations will enable the surgeon to determine what course to pursue. Abdominal section is always justifiable in cases of internal hæmorrhage sufficient in amount to threaten life. A number of gunshot wounds of the abdomen have been related in connection with gunshot injuries of the neck and chest, in which the cavities of the chest and abdomen and their contents were implicated at the same time, and which are on the way to recovery without laparotomy having been performed. I have seen a number of cases of perforating wounds of the abdomen in the first and third division hospitals that were on a fair way to recovery without operation, before they were sent home on transports. In most of these instances the bullet wounds were either in the umbilical region or in one of the iliac fossæ. The

following case presents features of more than usual clinical and surgical interest:

CASE XXII.—J. F. Taylor, Company D, Tenth Cavalry, was wounded July 2d. At the time the injury was received he was in the ventral prone position. The bullet entered the left shoulder in the infraspinatus fossa of the scapula, and passed downward and inward and lodged under the skin in the median line, two inches above the umbilicus. Hæmoptysis considerable during the first day, when it gradually subsided. He complained of great pain and tenderness in the right side of the abdomen. No vomiting or symptoms of more than a circumscribed peritonitis. An abscess formed in the abdominal wall, which was opened July 20th, and the bullet was removed. From this time on the patient improved rapidly.

Gunshot Wounds of the Extremities.—It is a source of gratification to know that few primary amputations were made for gunshot injury of the extremities. All of the surgeons realized the importance of conservative measures in the treatment of such injuries, and limited amputations to cases in which the condition of the soft tissues precluded any other course. A number of secondary amputations became necessary to save life in cases of infected compound fractures complicated with injury and infection of the adjacent joint. Two cases of traumatic aneurism are now on board the *Relief*—one an aneurismal varix, the other an aneurism of the femoral artery.

CASE XXIII.—Captain Mosher, Company G, Twenty-second Infantry, received a bullet wound July 1st, during the advance on Santiago. Those who saw the patient first assert that the hæmorrhage was severe and that he lost consciousness. He was removed to the first division hospital and transferred, July 10th, to the third division hospital, and the following day he was brought on board the *Relief*. I examined the patient at the front four days after the injury, and confirmed the diagnosis made by the attending surgeons, who had recognized the anatomical nature of the aneurism. The wounds healed by primary intention in less than two weeks. One wound was in the middle of Scarpa's triangle, and the other at the level and one inch posterior to the great trochanter on the same side. From the fact that there is shown by the radiograph a piece of the jacket of a bullet in the right popliteal space, it is probable that he was wounded by a plunging fire and that the bullet inflicted the latter wound after emerging from the wound in Scarpa's triangle. The wound in the popliteal space is suppurating. The patient is very anæmic and weak. In the triangle directly under the wound there is a pulsating swelling in the direction of the femoral vein, which extends to Poupart's ligament. Fremitus and the characteristic bruit extend a considerable distance above and below the communicating opening between the artery and vein. The treatment consists in rest and tonics. The general health of the patient is improving, but there is no change in the local condition. The men-

tal condition, much impaired since the injury, is gradually improving.

CASE XXIV.—John J. Welch, Company M, Second Massachusetts Volunteers, was wounded July 1st. The bullet entered Scarpa's triangle three inches below Poupart's ligament, directly over the femoral artery, and escaped at a point corresponding with the gluteal crease and to the outside of the femur on the same side. Not much hæmorrhage. A well-marked aneurism developed, presenting all of the physical signs characteristic of such a pathological condition. The swelling is somewhat elongated, a little larger than a hen's egg, and has not increased in size since the patient came on board the hospital ship. The leg is somewhat œdematous and painful.

A number of gunshot fractures of the thigh and leg have become infected, and are now being treated by establishing free tubular drainage and resorting to frequent or continuous antiseptic irrigation. Owing to the want of reliable plaster of Paris, we had to resort to various kinds of splints, simple and double inclined plane, in effecting immobilization. The sheath of the leaf of the cocoa palm has served as an excellent material for this purpose. There is every prospect that most of these cases will ultimately recover with useful limbs.

In conclusion, I desire to thank Surgeons Metcalfe, Torney, Greenleaf, Morrow, Hartsock, and Schultze, for valuable assistance in preparing this communication.

ON BOARD THE HOSPITAL SHIP "RELIEF,"
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THE ADVANTAGES AND DISADVANTAGES OF Q. F. GUNS FOR ARTILLERY IN THE FIELD.

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SECTION I.—INTRODUCTION.

OF the enormous importance of the subject set by the Institution for this year's essay, there can be no two opinions. The development in power of guns and their projectiles—manifesting itself in one direction by high muzzle velocities, in another by vastly increased rapidities of fire, and in a third by the introduction of heavier calibres, and shells filled with explosives of a power and capacity for destruction far exceeding anything hitherto known—is merely a part of a prevailing military activity and competition among the greatest powers of the earth which has probably never before been exceeded. This, coupled with the tornado-like suddenness of outburst and swiftness of decision of modern war, and the gigantic value of the interests involved, especially to our own country, now at this moment at a very

zenith of prosperity and wealth, and which gigantic interests it is the function of our navy and army to guard—render it imperative that no pains should be spared to examine thoroughly every new development in material; to separate the sound from the unsound, and, while rejecting the latter, to take care that we do not lag behind in adopting the former, lest we should find ourselves confronted with superior armaments when the day of trial comes.

Animated, therefore, by no preconceived notions or theories, but with an honest desire to find out the truth, let us humbly try to examine into the advantages and disadvantages for artillery in the field of one of the above indicated lines of recent artillery development, viz.: the introduction of quick-firing guns.

The point of view from which this question must be really regarded is not merely small technical details concerning the guns alone, but the suitability or otherwise of an artillery thus equipped for the general service of a modern army. It is however desirable, and even necessary, to devote a small portion of space to examine whether there is anything inherent in Q. F. guns, as they at present exist, which unfits them for use as field-guns, and this point will be dealt with in the next section.

SECTION II.—THE LEADING CHARACTERISTICS OF EXISTING QUICK-FIRING GUNS WITH SPECIAL REFERENCE TO THE SUITABILITY OR OTHERWISE OF EACH FOR ARTILEERY IN THE FIELD.

Quick-firing guns already exist, of all sizes, from the little 3-pounder and 6-pounder, to the great 6-inch firing a 100-lb. projectile, and even an 8-inch. Not only are there varieties in size, but there are varieties of pattern among guns of the same size made by different makers, each having his own patents. Nevertheless all possess in some form or other the following characteristics:

1. A rapid breech action—all the minor operations of ejection of empty cartridge case, cocking the lock, etc., being automatically performed by the mere action of the breech lever in opening and closing the breech.

2. A greatly simplified ammunition (in the smaller natures made into a single cartridge like a large rifle cartridge).

3. The recoil of the gun is entirely absorbed by the mounting, and the gun itself automatically and instantly replaced in the firing position, after discharge.

4. The sights are arranged for continuous laying, *i.e.*, the layer can continually look over them, undisturbed by the service, or even the recoil, of the gun. They are generally fixed to the mounting and not to the gun itself, and in all cases can be manipulated without removal.

5. The gun is entirely under the control of the layer, who is independent of any other man for training or elevating.

6. The firing is invariably done by the layer by means of a trigger or very short lanyard.

7. And, when great rapidity of fire is essential, only percussion fuses are used.

Running through these details *seriatim*, as to their applicability to field-guns we find :—

1. *Breech Action.*—With our present mechanical knowledge, and numerous existing designs, there should be no difficulty in designing a pattern of gun to fulfil all requirements.

2. *Simplified Ammunition* generally takes the form of a metal cartridge case containing the charge, and percussion cap or other means of ignition, and, in the sizes below 12-pounder, holding the projectile in its mouth. With such ammunition, and with a suitably mounted gun, an extraordinarily rapid fire can be delivered—more than 30 rounds have been fired in one minute from a 3-pounder when the gun has not been laid.

But such ammunition possesses grave disadvantages for field artillery—the weight of the metal cases is considerable (that of even a 6-pounder weighs 2¼ lbs.), and this weight as well as the space taken up by the cases in the limbers reduces the number of rounds which can be transported in the carriages (aluminum cases have been tried but without success). Moreover this kind of ammunition is very liable to injury.

But is there any necessity for metal cases? Field-guns do not require such a tremendous rate of fire as is necessary for the navy, where antagonists may often approach at the rate of 1000 yards a minute, and where the very existence of a ship may depend upon the amount of fire she can deliver during a few fleeting moments. Coast-defense guns also have to be capable of very great rapidity when required, owing to the high speeds of their targets. But the field artillery can be content with a far lower rate of fire.

As a proof that the metal case is not essential even for rapid rates of fire, stands the fact that in the very latest developments of Q. F. guns it has been found possible to do away with it.

In the *Times* of 15th December, 1897, there appears an account of the trials of a new pattern of 6-inch Q. F. gun, which beat all previous records as to speed, for a gun of that calibre, and in which the metal case is no longer used. Many of the rounds were fired within seven seconds of each other, in spite of the great size and weight of the gun and ammunition.

It may therefore be safely affirmed that a rate of fire amply sufficient for field artillery requirements can now be attained without the disadvantages of the metal cartridge case. And this from a field artillery point of view is a conclusion of the highest importance.

3. *Absorption of Recoil.*—There is no doubt that the full and complete absorption of recoil attained by garrison and naval mountings, and absolutely necessary for the high rates of fire and the high velocities of projectile required for those services, can never be obtained in a field-gun

mounting. But at the same time it is equally certain that a very good practical absorption, sufficient for the more moderate speeds of fire and more moderate velocities of field-guns, is now quite possible, by the use of all latest mechanical devices and by a due adjustment of weight of projectile and muzzle velocity to the weight of gun and carriage. For the proof of this proposition we must turn to foreign powers. Germany and France have both, as will be shown hereafter, already given practical proof that in their opinion they have defeated this difficulty—and what can be done abroad can be done by ourselves.

It may therefore be taken as proved, that by a proper and up-to-date design, not of gun alone, or mounting alone, but of the whole system considered as a whole, the recoil may be so far absorbed that a field-gun can be effectively fired with far greater rapidity than our present guns.

4. *Sighting* can be dismissed in a few words. Sights already exist which can be manipulated with great ease and clearness, and without being removed from the socket, and their position, etc., is merely a detail of design—no difficulty exists.

5. It is very difficult in a field carriage to give the layer full control over his gun without introducing complications, but as much as possible must be provided for.

6. *Firing Arrangements.*—A most important detail, and one deserving of a very large amount of space to itself, could such be afforded. All that can be said here is that there is no impossibility about designing some more or less automatic firing gear to fulfill the requisite conditions.

There can be little doubt that some sort of percussion firing gear must some day supersede the present cumbrous system of tubes and lanyards, requiring several operations to put in the tube, work the lanyard, fire the gun, and remove the fired tubes.*

7. *Fuses.*—Time fuses can certainly not be abandoned for field artillery, and it appears possible that, in case of a Q. F. field equipment, the rate of fire which could be maintained, might, unless careful arrangements be made to prevent it, be limited by the rate at which fuses could be set.

It must be remembered however that there is no reason why two or even three men should not be setting fuses simultaneously. With a non-recoiling gun requiring no running up, and the layer doing his own pointing and firing, the men at present engaged in those duties would be available and no difficulty need be apprehended on this score. It would resolve itself into a matter of drill.

It would appear from a consideration of the foregoing, each item of which appears to be clearly established, that, in the present state of our

* Possibly a very small detachable magazine, like that of a Lee-Metford rifle on a small scale, and containing small percussion cartridges, slipped into guides on the breech at the moment of coming into action, automatically worked by the block, and its lock fired by a trigger or short lanyard or toggle, would be found highly suitable for the class of gun now under consideration: of course when exhausted a fresh magazine could be instantly attached. The supply of full magazines would be carried in pockets along the sides of the trail.

knowledge, there is no inherent impossibility in the proposal to make available the Q. F. type of guns for the use of the field artillery, provided that such an armament be considered suitable in other respects—whether this be so or not, will be considered in the following sections.

SECTION III.—THE ADVANTAGES OF A QUICK-FIRING EQUIPMENT FOR ARTILLERY IN THE FIELD.

These may be summed up under three general heads, each of the highest importance:

1. Greatly enhanced intensity of fire.
2. Quick ranging, and
3. Less frontage required for a given amount of fire—or conversely a far greater amount of fire possible from any position of given extent.

1. *Intensity of Fire.*—It will be readily granted that the more intense the fire of which any arm is capable, the greater is its effect and the greater its chances of subduing its enemy.

Intensity of fire has hitherto been striven for by bringing into the field the greatest possible number of guns.

But supposing this to be equal, then intensity of artillery fire (shrapnel) can be arrived at in two ways, either by a very rapid succession of medium sized shell or by a slower succession of heavier projectiles; each of the latter however releasing, on bursting, a larger number of bullets than each of the former.

Let us suppose for a moment that the two above systems are designed so equally that each is capable of delivering exactly the same number of shrapnel bullets per minute on the enemy's position, and that they are pitted against each other. There seems little doubt that, even assuming equality in number of bullets per minute, the former will prevail. For the rapid arrival of shell after shell will be most demoralizing. Most of those who have as boys played in the water while bathing are aware how much more difficult it is to face a continuous and rapid splashing, even of small drops, than to endure the same quantity of water dashed, say, in bucketfulls, at comparatively large intervals. The former allows no time to take breath. In the case of shrapnel fire there can be little doubt that the effect on a battery—or on any other arm—of a shrapnel fire, arriving at the rate of say twenty shells per minute, would be far more demoralizing than the same number of bullets released from shells arriving at the much slower rate of say six rounds per minute. Bewildered by the incessant bursting of shells, without time to repeat orders, to replace casualties, or even to clearly descry the enemy, the best officers and layers would be terribly handicapped, their return fire will be slow and ineffective, and the slower artillery will be overwhelmed.

The above is believed to be true, even should the numbers of shrapnel bullets capable of being delivered per minute be equal. But this is far from being the case.

What actual rate of fire may we reasonably expect from a Q. F. field equipment?—For data we have the known capabilities of garrison Q. F. guns of about the same calibre, from which, however, a considerable deduction must be made to allow for the more unfavorable conditions of a gun in the field, as regards steadiness of mounting and absence of recoil. We also know pretty well how long is required for the actual operation of laying, when this is under the control of the layer alone who is not dependent upon others.

With a target of good visibility and fair size, even though it may be in fairly rapid motion, it is believed that a garrison 12-pounder Q. F. gun could maintain a rate of aimed fire of 10 rounds per minute—at a stationary target it could certainly be done with ease.

If we have this to allow for the more unfavorable circumstances in the field, we get a possible rate of 5 rounds per gun per minute.

Checking this by the time taken to lay a gun, without the delays involved by signalling to the number at the trail, there is no doubt that any fairly good layer can finish his laying in from 12 to 15 seconds; of course fumbling with the sight, etc., is not taken into consideration, as vastly improved sights would of course be fitted.

There therefore seems no doubt that, with a target of fair visibility, any Q. F. field equipment worthy of the name should be able, when required, to pour in a fire at the rate of from 4 to 5 rounds per gun per minute, or a total rate from the battery of 24 to 30 rounds per minute—an intensity far surpassing anything hitherto known.

Examples are hitherto wanting of the effect of Q. F. guns in the field. But since the effect of what may be termed a storm of artillery projectiles, is much the same, whether these come from a few Q. F. guns or a large number of ordinary guns, we can find in history examples in proof of what has been said above. For instance, speaking of the German guns at Sédan, von Moltke says ("Moltke's History of the War"): "And now the fire from the 26 batteries of the Army of the Meuse was joined by that of the Guard's Batteries, which took up their position at the eastern slope of the Givonne Valley. The effect was overwhelming. The French batteries were destroyed, and many ammunition wagons exploded."

This instance of the effect of an intense fire was produced by numerical superiority of guns. But a similar intensity will be a property of a Q. F. equipment when the number of guns are equal.

Taking then a possible rate for a battery of 20 rounds per minute as well within the mark, it is evident that such an armament will have an immense advantage in fire effect over existing equipments.

It is perhaps hardly necessary to point out that in speaking of rates of fire of 20 to 30 rounds per minute it is not intended to argue that such rates would be used for long periods and under all kinds of circumstances. Rather are they to be considered as a potentiality—a latent power—capable of being developed at critical moments, and adding to

that artillery which can first and best realize the true possibilities of this new property of the arm, and which can best train its officers to make full use of this property, a commanding power on the field of battle.

2. *Quick Ranging*..—Of more importance than the preceding, is the power of quick ranging, some development of which must form a leading feature in the true use of a Q. F. armament.

The vital importance of quick ranging cannot be over-estimated. There can be no reasonable doubt that, with the present accuracy and efficiency of artillery, if two practically equal masses of that arm come into action against one another, that side which first establishes the range, and first commences to pour in the terrible fire above described, will in all probability overwhelm its adversary, and this, too, while suffering but little loss itself.

Even in 1870, when only common shell (which we now consider as a quite ineffective projectile) were in use, ranging, in the face of guns which had already got the range, was in many cases found to be impossible, or at any rate very difficult.

Prince Kraft, in one of the personal reminiscences contained in his letters (p. 149), gives a graphic description, too lengthy to quote here, of the difficulties experienced in ranging, against an enemy who has already got, or nearly got, your own range. And he also incidentally mentions that at Sédan the process of ranging the German batteries, with which he himself was connected, took over an hour, owing to the enemy having first got the range.

Again, referring to Gravelotte, when the line of German guns was established between the Bois de la Cusse and Gravelotte, Hoffbauer tells us: "Repeated attempts made by the French to bring fresh batteries into action were invariably baffled by the accuracy of our concentrated fire. Many of the guns could not even unlimber, and others which succeeded in doing so were obliged to retire after firing a few rounds. Explosions of ammunition wagons and limbers were frequently observed."

If this were the case with the armaments of 1870, what chance would batteries have of successfully ranging under the rain of bullets from bursting shrapnel delivered by a Q. F. equipment?

Speed, therefore, in ranging is all-important, and there can be no doubt that a Q. F. armament will lend itself very readily to improvements in this direction. The value of minutes—nay, even of seconds—at this vitally important crisis—for crisis it is when well-trained artillery meets well-trained artillery on the modern battle-field—is not to be described in words, nor measured by ordinary standards. The slower artillery will pay for those precious minutes with the lives of many gallant men and horses. Its influence on the battle-field will be nullified—the other arms, looking to their artillery for support, will look in vain, for it will be reduced to impotence—and woe to that army and to that nation whose artillery is overmatched.

The laying of stress on this point is by no means intended as a criticism of present methods, the outcome of so much thought and practical experience, and so well adapted to the armaments now in use. But there can be no doubt that the property of the Q.F. gun, of being always ready and able to fire, should be utilized, if it possibly can, in making improvements in this direction—*autre temps, autres mœurs*—new armaments, new methods—and that several new departures in ranging will be possible with Q.F. guns is evident. True we shall have to pay a price for the time that we shall gain, viz.: the expenditure, on the process of ranging, of what we should at present regard as a somewhat reckless amount of ammunition; but what is the value of a few shells compared with the tremendous interests at stake when artillery has to get the mastery over artillery or be itself destroyed.

No; time must be gained by every possible means, and the introduction of a new armament would be useless were our tactics not modified so as to take full advantage of its peculiar properties and powers.

3. *Frontage.*—The property which a Q.F. armament possesses, of delivering a vastly more powerful fire than has hitherto been possible from any given length of front, or conversely the smaller amount of frontage required, for the delivery of a certain amount of fire is one of very great importance. For the Continental powers, who have hitherto brought gigantic numbers of guns into the field, it will now be possible to reduce this number, and the crowding of large numbers of guns into positions too small for such numbers, or the squeezing out of batteries altogether from the artillery line on account of want of space—as was the case in the German line at Gravelotte, for instance—will be less frequent than formerly.

To a nation like ourselves, always too weak in artillery, and hitherto quite unable to compete in numbers of guns with the huge armaments of our neighbors, the increase of fire power from our limited number of pieces, taken in conjunction with a probable reduction in the numbers of those of our neighbors, is an unmixed advantage, as tending to bring matters more on an equality. Abroad, the gain in power of guns must be partially counterbalanced by a reduction in their present numbers, necessitated, as will be seen immediately, by difficulties as to ammunition supply for very large numbers of guns of this type. In our case, owing to our smaller number of guns, we need think of no reduction, and the gain in fire power would be absolute.

SECTION IV.—THE DISADVANTAGES OF A Q.F. EQUIPMENT FOR ARTILLERY IN THE FIELD.

These may be enumerated as follows:

1. The great expenditure of ammunition and consequently large amount necessary to be provided and always at hand.

2. The excessive length on the roads of the ammunition columns and parks.

3. The difficulty of keeping up the supply of ammunition to the guns at the required rate in action.

4. The greater complication of gun and mounting rendering it unfit for service in the field.

5. The possible sacrifice of mobility owing not only to the greater amount of ammunition to be transported but to the possibly greater weight of gun and carriage.

6. The possible loss of shell power due to modification in calibre of gun, weight of projectile, and muzzle velocity.

7. The necessity for still higher training of personnel—officers and men.

1. *The expenditure of ammunition.*—It is, of course, obvious that guns of the type under discussion will, from their very nature and properties, demand a very large supply of ammunition. But how much? Will the amount required be within practical limits, or are the dreams of those who picture the field battery of the future as consisting of two Q.F. guns and twelve or more ammunition wagons, actually near the truth.

How many rounds per gun will be required in the field for a Q.F. field equipment?—This must form the very basis upon which the whole design and organization of such an armament must be founded. The question, vitally important as it is, is unfortunately one as to which practically no reliable data appear to exist, and the true answer must be left to the matured judgment of our most experienced officers. But as for the purposes of this memorandum, it is necessary to have some figures to go upon, it has to be discussed.

If we examine the expenditure of ammunition by the German batteries in 1870, as given by Hoffbauer, it becomes clear that no general law can be deduced, even from this large record of actual experiences. The expenditure is dependent upon so many circumstances. Some batteries come into action much earlier than others, some find themselves in the very focus of the struggle, while others find their allotted part on some comparatively distant eminence. The very combat itself may be short and decisive or lengthy and protracted. We thus find such discrepancies as the following: On August 14th, at Wörth, of the artillery of the 1st Army Corps, the 1st light field battery fired 302 shell and six case, while on the same occasion the 3d light and 4th light batteries only fired one shell each. The general averages on this day were:—

1st A.G. and 1st Cavl. Dn.	(15 batts.),	137	rounds	per	battery.
7th A.C.	(9 "),	75	"	"	"
9th A.C.	(2 "),	51	"	"	"

General average of the 26 batteries engaged, 110 rounds per battery.

On August 16th, at Vionville, the expenditure of individual batteries varied between 1164 rounds by the 3d Horse Artillery Battery of 3d Corps, and 1148 of 1st H.A. of same corps, down to 38 and 41 respec-

tively by 2d heavy and 1st light of the 9th Corps. The 15 batteries of the 3d A.C. averaged 768 rounds each, and the general average of 36 batteries engaged works out at 545 rounds each.

On August the 18th, the great day of Gravelotte, while two batteries of the 9th Corps fired close on 1000 rounds each, no less than eight batteries fired less than 10 rounds each.* The average expenditure of the 9th A.C. was 526 rounds per battery, and the general average of 109 batteries works out at 318 rounds each. Although at first glance such variation even of large averages appears somewhat hopeless, yet it incidentally leads to one most important conclusion. It is this: that, in future organizations, the great bulk of the ammunition supply must take the form of free ammunition, not tied to particular batteries; and only sufficient need be with each battery to keep it supplied for a moderate time. It is evident that if every battery had to carry with it an enormous train of wagons, containing sufficient ammunition for all probable requirements, there must be great waste of road space and mobility as probably only a few batteries would expend the full amount carried on any particular occasion. This consideration effectually disposes of the two gun and 12 wagon theory, and gives a most important and valuable principle to go upon, viz.:

That in organizing a Q. F. field armament no excessive amount of ammunition supply should be provided with the batteries, but that the extra ammunition, necessitated by the different type of gun, must be entirely carried by a highly-developed and well-organized system of ammunition columns, which has to be created. Very stringent regulations will also be required that other troops are to make way for the advance of ammunition columns.

We are however at present no nearer to estimating the actual number of rounds required than before. But when we find that in the great battles of 1870 it was quite exceptional for a battery to fire more than 1000 rounds in any one battle, and that batteries which did this were those which had been brought earliest into the fight, and been most actively engaged; as for instance Korber's horse artillery batteries at Vionville, which, commencing by surprising the French camps soon after 8.30 A. M. were engaged in a more or less continuous struggle till darkness put an end to further fighting—we see that in those days 1000 rounds per battery would have been an amply sufficient supply of ammunition for any one day, and the German rate of "rapid fire" was more rapid than our present rate.

Several battles in quick succession, as happened round Metz in 1870, have however to be provided for.

To estimate the expenditure of Q. F. guns it must be remembered that although the fire may be at times very rapid, yet the production of effect will be also very rapid. In fact, granted good fire discipline and

* Three batteries only fired one round each, one fired two rounds and two only three rounds each.

good shooting, there seems no special reason why more projectiles should be required to attain a given result when the fire is rapid than when it is slow. Nay, the very fact of producing results rapidly, is of itself a factor of great power. It would almost appear possible that for any given object fewer rounds will be required to produce decisive results, than before. But the batteries will not permit themselves to remain idle, and therefore more rounds will certainly be used in the day's work than with slow firing equipments.

We turn to the infantry, to see what increase they have made in their supply of ammunition since they adopted Q. F. rifles—for the so-called "magazine" is simply a Q. F. rifle as compared with former patterns—but it is not at all easy to ascertain what has been the average increase in the number of cartridges carried per rifle, since this was adopted by all the great powers. So far as can be made out the total number of rounds per rifle taken into the field appears to have been about doubled. The writer is not aware how far this increase has been based on detailed estimates, or whether it has been merely a rough increase. It is probably, for infantry, an abundant estimate, as, although, in individual cases of regiments hotly engaged, the amount may become exceeded—over the great bulk of a whole army there is sure to be a plentiful supply.

Artillery expend more ammunition in proportion than infantry, as they come into action early, and remain in action until all is over, moreover nearly every gun is engaged, while whole battalions stand in reserve without firing a shot. It may therefore be safely said that the increase in artillery ammunition should be at least as great as the increase in infantry ammunition due to the same cause, viz., the introduction of a Q.F. arm. It must not be forgotten that part of the German artillery was short of ammunition for some time after the continuous fighting in August: some of the batteries being short for several weeks in spite of the strenuous efforts of the columns.

It is somewhat difficult owing to recent changes in equipment, and the somewhat inchoate condition of our ammunition columns and parks to ascertain exactly how many rounds our artillery at present are supposed to carry. But it is undoubtedly putting it very near the mark to assume that (supposing 12-pounder ammunition to be in question) we could, without any great alteration to the establishment of ammunition columns and parks at present understood to exist, carry with the army for each battery, the following number of rounds, viz.: with battery, 816; in ammunition columns, 450 (about*); and in park, 434. Total, 1700 rounds per battery.

It would appear, therefore, from the above reasoning that a Q. F. equipment necessitates the provision, and carrying in the field, of at

* Apparently each divisional ammunition column carries 444 rounds per battery for the divisional artillery, while the corps column together with the Cav. Bde. column 462 for the corps artillery.

least 3500 rounds per battery. It further appears that about 1000 rounds is all that should be carried by the battery itself, leaving 2500 rounds per battery to be divided between the columns and park.

It would seem desirable, for many reasons, to have as much as possible of this with the columns. In round numbers we might suggest 1000 rounds per battery with the columns, leaving 1500 rounds in the park.

This very formidable result brings us to the next disadvantage to an army in the field, viz. :

2. *The excessive length on the roads of the ammunition columns and parks.*—This is a serious drawback to a Q. F. equipment, especially when it is remembered that some batteries may very possibly be in need of the ammunition columns quite early in the fight, and these must therefore be well to the front.

It is quite evident that a most radical change in the present arrangements is absolutely necessary, and the lumbering, unwieldy ammunition column, dragging its slow length along the roads, must be supplemented by some light and mobile units, well officered, and capable of moving at good speed across country.

The ammunition columns might then then be organized as follows :

All existing columns be retained and organized as at present, but each army corps to have four additional flying columns, each consisting of 22 carriages under command of a captain,

The very interesting tables marked A to D in the appendix show exactly the effect on the artillery impedimenta, taken as a whole, of the above indicated changes. Table A gives the length of road occupied by each nature of ammunition column as at present constituted (Field Army Establishments, Home Defense, 1892*). It also shows the amount which could be deducted from each if the infantry ammunition were separated from that of the artillery. This table serves as a foundation for Table B, which compares the road space occupied by the ammunition columns organized as at present with those organized as proposed.

Table C gives a similar comparison for the batteries themselves of the A. C., while Table D combines the two preceding and gives the exact total space occupied by the artillery of an A. C. under the two systems. The total difference is 2700 yards. Distributed over three roads the difference is only 900 yards on each road, a small price to pay for the advantages of a better weapon.

The immense importance of the work of ammunition columns would have to be recognized.

Cadres for the full number required would have to be kept up in time of peace and constantly used. When not being manœuvred with the brigade division special attention would be devoted to cross country marching.

* Columns for service abroad apparently only differ in the addition of one wagon for tents.

Although spoken of as ammunition columns, the new units would be better described as the second echelons of wagons. They would not receive, nor expect to receive, any orders from their Bde. Dn. Commanders. It would be their duty to make their way to the front, across country when necessary, and to report their arrival to their Bde. Dn. Commanders at the earliest possible moment after firing has commenced.

Stringent regulations would have to be issued that on no account are ammunition columns to be blocked, and in time of peace the other arms should be habituated to the constant presence in the field of numerous columns, making their way independently to the front in whatever manner seems best to them.

So far as the parks are concerned they would remain very much as at present, but with the exception that, to save space on the roads, the additional wagons carrying the extra rounds, over and above those now provided for, would only be drawn by one pair of heavy horses each. Sooner or later it seems certain that steam traction (or other motor power) must be applied to military uses, and an enterprising nation might initiate something of the sort. The saving in length of columns would be very great—the possibility of danger is, with modern ammunition and methods of packing, so small as not for one moment to be allowed to weigh against the advantages. Of course proper engine drivers and a few fitters and other mechanics would have to be with the park.

3. *Difficulty of keeping up the supply of ammunition to the guns at the required rate when in action.*—This could be overcome by an extension of the portable magazine system to the whole packing of all the carriages; shells would no longer be packed individually but in groups of three or more, fastened together by a steel band or some such contrivance, each group having its cartridges with it in the same magazine. Each of these would be removed bodily from the wagon and supplied to the gun *holus bolus*.

The gun being non-recoiling, the wagons might be brought up much closer to them than at present.

4. *The greater complication of gun and mounting unfitting it for service in the field.*—This is a vague and general objection which cannot be dealt with specifically until we have before us an actual gun and carriage. But speaking generally we all hate and fear complication.

There can be no doubt that simplicity, and extreme simplicity, should always be kept in view, but it must not be allowed to override all other considerations.

We must not forget that the introduction of breech-loading guns was viewed with immense disfavor, and actually deferred for some years on this very ground. They are doubtless much more complex than the muzzle-loaders they succeeded, and yet how little noticeable is this now that they are thoroughly known.

Again, the undoubtedly complicated Maxim gun was looked at ask-

ance, until tried by private enterprise in South Africa and found a success in the field. Here again the misgivings proved unfounded.

An apparently striking instance of the disadvantages of complexity is afforded by the introduction in its original form of what is known as the Mark II. carriage, designed as an improvement on the Mark I. pattern, but which experience showed to be full of defects, many of them serious. This will doubtless be remembered and quoted in support of the above objection.

But it is only right to remember that this pattern showed no practical advantage to set off against its added complexity and weight. Had it, for example, been a non-recoiling carriage, requiring no running up after firing, it might possibly have been forgiven its cumbrous and unwieldy tire brake gear. Had a markedly superior rapidity of laying been obtainable from its traversing gear, this too might have been viewed with less disfavor; but seeing that there were no tangible advantages to compensate for the extra complexity and weight, it is not surprising that it was disliked, and has since been stripped of most of its complexities.

It is probable that with the wider knowledge now available, especially in this matter of very powerful springs, new designs of carriages, while possessing immense practical advantages, would not necessarily be very complex, while the guns themselves may very likely be even simpler than our present ones.

One thing is quite clear, that to avoid complexity, both gun and carriage must be designed together as one system, not as two separate items.

5. *The possible sacrifice of mobility owing not only to the greater amount of ammunition to be transported, but to the possibly greater weight of gun and carriage.*—It has already been shown that the transport of the extra ammunition should make no difference to the mobility of the batteries themselves. With reference to the weight of gun and carriage, as this is greatly mixed up with the size of gun and projectile likely to be adopted, it is convenient to discuss at the same time the next disadvantage, viz.:—

6. *The possible loss of shell power, due to modifications which may be found necessary in calibre of gun, weight of projectile and muzzle velocity.*—It is as well to be quite clear on one point. If the adoption of a Q. F. equipment be found to necessitate any real and serious loss of mobility of the batteries, it cannot be thought of.

The key to the whole of the vast subject opened up by these two objections lies in one word, viz.: Recoil.

We have seen in Section II. that a practical abolition of recoil is a *sine qua non* if any of the advantages of rapid fire are to be obtained by artillery. It is not reasonable to suppose that by mechanical means alone we shall be able to entirely absorb the violent recoil of our present guns, and, even if we could, the necessary arrangements would undoubt-

edly add to their already high weight. The problem must be attacked from another side.

The energy of recoil of the system (gun and carriage), which is what we have to absorb, can be varied as we all know, either by increasing the weight, thus absorbing a larger amount of the shock before motion is established, or diminishing the shock by reducing either the weight of projectile fired, or the muzzle velocity given to it, or both.

It is quite evident that weights can in no case be increased. It will therefore be necessary in all probability to reduce either the weight, or muzzle velocity, of the projectile, or both. Though some shell power be lost by reducing the weight of projectile, yet the general lightening of load of all the wagons will be no small advantage, as a set-off.

Let us try to find out exactly what this loss of shell power will amount to. What combination of weight of gun and carriage, weight of projectile and muzzle velocity, will give a manageable amount of recoil?

And here we are confronted with a difficulty which can only be solved by experiment. Supposing for the sake of comparison that the energy of recoil be measured in foot tons, how much is permissible?

Tables E and F of the appendix give the recoils of our service guns, and those due to other imaginary combinations of the various data. All are worked out by the ordinary text-book formula, and serve for comparison.

Table E deals with data and recoils familiar to us all, and affords some sort of standard by which to realize the figures of Table F.

Doubtless by the employment of the methods largely used on the Continent, such as a broad spade at the end of the trail and very powerful springs to take the first shock, the recoils of our service guns could be considerably absorbed and thus shortened. At the same time no one can doubt that in both guns the amount of recoil is too much for complete absorption.

In Table F only round numbers and wide margins are given, the comparisons being in pairs, lettered A, B, etc., respectively. A comparison with Table E shows that there are many useful combinations giving smaller recoils than the present service guns.

It is impossible without actual experiment to say exactly what nominal energy can be successfully absorbed. Probably, by the use of proper means, a recoil of 0.8 to 0-9 ft. tons would be found quite controllable.

Calibre.—Before proceeding further it is well to consider whether the calibre should be reduced. The infantry have thus solved all their ammunition difficulties, but in their case a small bullet is as efficient as a large one. But though in the case of artillery the shells of smaller calibre pack closer, and though the breech-block and other parts of the gun may be made smaller and therefore lighter, yet the great loss of bullet-carrying capacity in small calibre shells make these very inadvisable for

artillery. We find in our own service that all the following guns have the same calibre, three inches, viz.:—15-pr. B. L., 12-pr. B. L., 7 cwt.; 12-pr. B. L., 6 cwt.; 13-pr. R. M. L., 9 pr. R. M. L., 8 cwt.; 9-pr. R. M. L., 6 cwt.; and 7-pr. R. M. L.

When this calibre has been at various times adopted for guns of such various powers as those in the above list, it is evident that it is generally suitable for field service. Moreover its adoption in conjunction with a 12½-lb. projectile would enable us to utilize our stocks of well known and tested projectiles, and save us from having to design and try new ammunition as well as new guns. It should not therefore be reduced.

We are now in a position to estimate the general possibilities of a Q. F. equipment.

Mobility is the first essential—the weight behind the team with four gunners mounted should if possible be kept down to 38 cwt., or say 4300 lbs. Of this the limber with two men would require 2000 lbs.; this leaves 2300 lbs. for the gun and carriage with two men on the axletree seats, or 2000 lbs. when unlimbered in action.

Next, an energy of recoil of 0.9 ft. tons should not be exceeded, while if possible a 12½-lb. projectile should be adopted.

A glance at Table F leads us to the conclusion that with above data a muzzle velocity of about 1350 to 1400 f. s. will fulfil the requirements.

It will be observed that, before the weight of the present 15-pounder is reached, there is a margin of 450 lbs., which, if necessary, can be added to gun and carriage, either to supply additional strength, or by mere inertia, to reduce shock. But on no account whatever should the weight of the 15-pounder equipment be exceeded.

Although 1400 f. s. appears a low muzzle velocity, a study of Table G in appendix shows how very little is really lost at most ranges by the reduction from 1540 f. s. the M. V. of the horse artillery gun; only about five per cent. at medium ranges.

We therefore conclude that a Q. F. equipment does not necessarily involve any loss in mobility, while the loss of individual shell power is limited to the substitution of a shell containing 162 bullets for one containing 200 and a lowering of velocity for practical purposes of only about five per cent.; against which must be set off the fourfold increase in the rate of fire. Table H in appendix sets forth the comparison in fire effect between such an equipment and the present service equipment, and shows an overwhelming superiority for the Q. F.'s.

7. *The necessity for still higher training of personnel—Officers and Men.*—There can be no doubt that an equipment of a distinctly higher order will demand corresponding advances in the training of its personnel. But this can safely be left to our officers and men. Calls made upon them have always been responded to. It will, however, be very desirable to give extra pay to trained and efficient gun layers, as is at present done in the garrison artillery.

SECTION V.—THE BALANCE BETWEEN THE ADVANTAGES AND DISADVANTAGES.

Having now carefully gone through the leading pros and cons of the whole subject, it behooves us to weigh them well. Momentous indeed is the question under consideration, for on the decision may hang the issue of our next struggle against the armed nations around us. Great are the advantages set out in Section III., and if fully realized in practice, they must be overwhelming. But great, too, are the disadvantages. On the one hand, we have an established armament, a system suited to that armament familiar to all ranks of our widely scattered regiment, and which has been the natural growth and outcome of many years experience, study, and work. On the other side lie vast possibilities indeed, but some uncertainty, for it is abundantly evident that the introduction of an armament possessing such different properties and powers to that at present in use, implies the introduction of new tactics.

But whilst the consideration of details on either side, tends to confuse the mind, with the complexity and variety of the numerous avenues of thought opened up before us, let us, in our search for guidance, lift up our eyes and look around.

The scene changes. Viewed from a more lofty standpoint, the tangled maze of advantage and disadvantage, of doubts and difficulties, sinks beneath our feet and assumes its true proportions.

What do we see?

In every country, in every department of commerce, and industry, we see one prevailing tendency towards an increase of speed. Broadly speaking, this is the general line along which all things are moving, some, so to speak, of their own initiation and volition, others unwillingly forced along this line of progress by the mighty and resistless march of events. Within recent years we have seen the effect on business of the introduction of rapid communication through the telephone; ships cross the ocean at speeds steadily increasing; in the designs of vessels for warlike purposes, higher and yet higher speeds are continually being aimed at, while the immense, but slow working guns, formerly in use, have been discarded in favor of quick firers. Coast defense guns are following the same lines. The infantry of all nations have adopted quick-firing rifles—for such is the true property of the so-called magazine rifle—and the even more rapid Maxim and other automatic shooting machines have been introduced. Even to the individual, cycles have given power of rapid locomotion previously unknown, and year by year we find these geared to higher speeds.

Where, in fact, can we turn, without seeing clear evidence of this tendency of the times?

Should, however, any be disposed to think that this universal tendency may have one exception—that that exception is in the matter of field artillery—and that consequently field artillery can stand fast in its

present condition of efficiency, and view with indifference the striding progress of all round—let these consider the following extracts taken from the ordinary daily press during the last few months.

In the *Times* on the 29th of June, 1897, there appeared among the telegrams from Berlin, a short note on the work of the German Reichstag during the session, 1896-97. The following little sentence is pregnant with meaning and warning: "A vote of 44,000,000 marks for the introduction of quick-firing artillery was quietly passed with the approval of all parties except the Socialists."

Five months later, in the *Morning Post* of 15th November, 1897, appeared the following paragraph: "The transformation of the French field artillery is so far advanced that 100 batteries of six pieces each, are already available for service. Detachments from each artillery regiment are being trained to use the new guns at Châlons. The secret has been well kept. The new weapon is called the "Déport gun" after Colonel Déport its inventor. It is of course quick-firing, and throws steel shells of 75 millimetres calibre. The Déport gun is said to be far superior to the present German artillery, and to have no recoil owing to an ingenious mechanism."

In the face of the above, can any one doubt that the time has come for the re-armament of our horse and field artillery with an up-to-date weapon?

Two great nations, with full sense of the great responsibilities involved, have taken the plunge, and is not this a proof that in the opinion of many great authorities the balance of advantage and disadvantage is on the side of the improved weapon?

It has been suggested by some as a kind of compromise, that the horse artillery only might be re-armed, leaving the field artillery as it is. It is submitted that the whole of the foregoing plainly demonstrates the fallacy of such a view. The success of a Q.F. equipment, must depend on interchangeability and organization. Partial measures would rather weaken than strengthen our position, and if re-armament be decided upon, every gun that may be brought face to face with modern continental artillery, should be of the same up-to-date pattern.

Artillery, like the navy, is a service that depends greatly for its efficiency on the character of its material. No amount of devotion or self-sacrifice on the part of its personnel can compensate for inferiority in armament; and, like the navy, its equipment should be always of the very latest quality.

SECTION VI.—CONCLUSION.

What is to be on the side of the superior artillery? Ask of the long, steady line of German guns at Gravelotte on an August afternoon some 30 years ago; before whose mighty fire, the opposing batteries were incessantly moving and shifting position. Ask too, of the immense horseshoe of German batteries deciding the destiny of the French empire on September 1st, 1870. To see what it is to be on the side of the

inferior artillery, let us regard the unfortunate French batteries at Sédan, destroyed, in spite of gallant effort, by the terrible storm of artillery projectiles coming from the surrounding heights.

What is it to an army to possess the superior artillery? The main feature of the Franco-German War was the commanding use made by the Germans of their artillery—the mighty power of this arm wielded as it was in masses—that is, producing its effect by means of a heavy and pitiless storm of projectiles—again and again exerted a tremendous influence on the fortunes of the battle-fields.

What is it to a nation to have the superior artillery? So far as we are aware, the teachings of all history show that victory has always declared for that side which has developed the most powerful artillery—and victory in battle means success in the campaign. Think of the cost of an unsuccessful war—the waste of life; the loss of prestige and power, trade and commerce, territory and money; what is the cost of an up-to-date armament in comparison with the many milliards of a war indemnity?

The importance therefore of a correct decision in the matter of artillery equipment is gigantic. The new conditions of things deserve the most careful consideration of our highest authorities, and should this consideration be found to establish the fact that a Q. F. equipment will have a decided superiority over existing armament, then let us boldly ask the government and the country for the money necessary to place our matériel on an equality with that of other nations, and enable our artillery—strong in the power of an intense fire when required—to perform its grand function of sweeping away all opposition in front of it, and—as has been well said by a great gunner—of opening up, for the other arms, the road to victory.

APPENDIX.—TABLE A.

The length of road occupied by each nature of ammunition column.

CHARACTER OF VEHICLE.	NATURE OF COLUMN.					
	Corps.		Divisional.		Cavalry Brigade.	
	No.	Total length, yds.	No.	Total length, yds.	No.	Total length, yds.
6 horse at 19 yds. each.....	24	456	25	475	9	171
4 " 15 " "	6	90	3	45	1	15
2 " 10 " "	2	20	10	100	8	80
Spare horses, say.....	..	24	..	28	..	16
Add about 20 per cent. for tailing, say.....	..	120	..	132	..	58
Totals.....	32	710	38	780	18	340
Deduct length of vehicles carrying infantry ammunition only.....	..	60	..	330	..	70
Balance—space taken up by artillery ammunition only ..	..	650	..	450	..	270

TABLE B.

Comparison of road space required for the ammunition columns of an army corps with present, and with a Q.-F. equipment.

NATURE OF COLUMN.	Present Equipment.		Q.-F. Equipment.	
	No.	Total length, yds.	No.	Total length, yds.
Corps ammunition column at 710 yds.....	1	710	1	710
Divisional " " 780 "	3	2340	3	2340
Cavalry Brigade, at 340 yds.....	1	340	1	340
Additional light flying columns, carrying 550 rounds per battery or 8250 rounds per A. C., packed in wagons each carrying 92 rounds—say 90 wagons at 20 yds each.	..	..	..	1800
Total	..	3390	..	5190

TABLE C.

Comparison of road space occupied by the batteries of an army corps with present and with a Q.-F. equipment.

NATURE OF ITEM.	PRESENT.			Q.-F. EQUIPMENT.			Remarks.
	No.	Length, yds.		No.	Length. yds.		
		Each Battery.	Total.		Each Battery.	Total.	
R. H. A Battery	3	300	900	3	360	1080	With the Q.-F. equipment three extra wagons per battery.
Field Battery.....	12	240	2880	12	300	3600	
Distances at 45 yds. each, Bde. Division.....	..	..	180	..	..	180	
Totals.....	..	..	3960	..	..	4860	

TABLE D.

Comparison of total length on roads of artillery impedimenta of an army corps with present and with a Q.-F. equipment.

NATURE OF ITEM.	No. OF YARDS OCCUPIED BY	
	Present.	Q.-F. Equipment.
Batteries (from Table C.).....	3960	4860
Columns (from Table B.)	3390	5190
Totals.....	7350	10,050

TABLE E.

Energies of Recoil of Service Guns.

NATURE OF GUN.	PROJECTILE.		Weight of Gun and Carriage. lbs.	RECOIL.	
	Weight in lbs.	M.V.		Velocity of in ft. secs.	Energy of in ft. tons.
12-pr., 6 cwt	12½	1540	1800	10.7	1.4
15-pr.....	14	1570	2500	8.7	1.3

TABLE F.

To show effect on energies of recoil of varying (1) weight of gun and carriage, marked A; (2) weight of projectile, marked B; (3) muzzle velocity, marked C and D.

Distinguishing Mark.	Projectile.		Weight of Gun and carriage. lbs.	Recoil.	
	Weight, lbs.	M. V.		Velocity, ft. secs.	Energy, ft. tons.
A	12	1400	**2500**	6.7	0.75
A	12	1400	**2000**	8.4	0.95
B	**15**	1400	2000	10.5	1.45
B	**10**	1400	2000	7	1.65
C	15	**1500**	2000	11.25	1.75
C	15	**1000**	2000	7.5	0.75
D	10	**1500**	2000	7.5	0.75
D	10	**1000**	2000	5	0.34

N. B.—Of course intermediate values can be interpolated between the extremes in each pair. The variable is emphasized in each case.

TABLE G.

Comparison of remaining velocities at different ranges due to a reduction of muzzle velocity from 1540 f.s. to 1400 f.s. in a 12-pounder projectile.

	Remaining Velocities at				
	Muzzle.	1000 yds.	2000 yds.	3000 yds.	4000 yds.
	1540	1137	947	823	726
	1400	1059	907	793	699
Differences.	140	78	40	30	27
Percentage of velocity lost.....	9 p. c.	6.8 p. c.	4.2 p. c.	3.6 p. c.	3.7 p. c.

TABLE H.

Intensity of Fire.—Comparison of the number of bullets per minute which could be delivered on an enemy's position by a battery equipped with the 15-pr. and one equipped with the 12-pr. Q. F.

Equipment.	Weight of Projectile, lbs	No. of Bullets in shell.	No. of rounds which can be fired in one minute.	No. of bullets delivered per minute on enemy's position.
Service, 15 pr.....	14	200	6	1200
12-pr. Q F	12½	162	{ 20 { 30	3240 4860

A difference in effect which must be quite overwhelming.

TRANSPORTATION OF THE WOUNDED IN WAR.

By JAMES P. KIMBALL A. M., M. D., Major and Surgeon, U. S. Army.

(*From Albany Medical Annals.*)

The removal of the wounded from the battle-field requires both organization of men and suitable implements for their use. The men and their tools will be considered in this paper.

The first stage in the travels of the wounded man is from the ground on which he has fallen to the collecting or first-dressing station. This station, according to army regulations, is "the nearest place to the combatants where the wounded and those caring for them may not be unnecessarily exposed to fire."[1] Formerly this was a distance of not more than five or six hundred yards, but the increased range of the modern rifle now necessitates the establishment of the first-dressing station at least one thousand to twelve hundred yards behind the firing line. There is usually one such station behind each regiment engaged, or if the regiments be small, one behind each brigade. To these stations bearers carry on litters the seriously wounded, after they have received on the field the necessary first aid, such as the application of a tourniquet in cases of severe arterial hæmorrhage, and of improvised splints to broken bones.

The bearers are a part of the sanitary force, which varies somewhat in strength in different armies, but is commonly equal to about four per cent. of the troops in line. In some of the European armies in which the proportion was less than four per cent. the rate has recently been increased, because of the general belief that in future wars the number of wounded will be larger than heretofore by reason of the greatly extended range of the new rifle. In our own army no definite plan has yet been formulated for fixing the ratio of the sanitary to the combatant force. If, however, we assume that the sanitary force is equal to four per cent. of the command, a division—the administrative unit of an army, which in our service numbers, on a war footing, 12,747 men[2]—will contain in round number a sanitary corps of five hundred men. This corps in most armies is composed of two classes, about equal in number—the hospital corps, which consists of men specially enlisted for the medical department and permanently attached to it, and the company or regimental bearers, who belong to the fighting force, and have been instructed in the duties of litter bearers and in the methods of giving first aid to the sick and wounded. During an engagement these bearers are temporarily detached from their companies for sanitary service with their respective regiments; that is, to give necessary aid to the wounded on the battle-field, and to carry the disabled to the first-dressing stations.

At the dressing stations and beyond, the wounded are cared for by men of the hospital corps.

The plan of taking men from the combatant ranks to serve as litter bearers is disapproved by some authorities, and the question is still an open one. Those who favor the plan argue that if there are no company bearers it will be necessary to make the hospital corps much larger than ordinarily required, in order that it may be strong enough to meet the emergencies of the battle-field, and that between battles there would thus be a large force of idle men.

Those who disapprove the system of company bearers say that officers in command of troops will be unwilling to part with men in the critical hour of battle—the hour which all their previous training has led up to. Furthermore, that if the force be composed of both combatants and non-combatants there would be a mixed control, and the medical officer could not therefore be certain of his men in the time of necessity.

A captain in the line who is dissatisfied with the present system—or lack of system—of providing companies with clerks, suggests as a compromise that the functions of company bearer and company clerk be combined in one man ; that he be unarmed, a combatant in name only, and that two men in each company be specially enlisted for this purpose. We believe that a homogeneous corps, at all times under the command of a medical officer, would be much more efficient than the dual force, and that any measure which lessens the usefulness of that part of the service whose mission is to relieve suffering and save life would be an unwise economy. The appropriate place for unarmed men, who are practically non-combatants, is, not the line, but the hospital corps. When not engaged in removing the wounded from the field, their services could certainly be made as valuable in the medical department as they could be in the companies of the line to which they might be attached.

In the organization of the hospital corps for service the men are assigned as follows : Some to form the detachments for duty with regiments, some to constitute bearer and ambulance companies, some to serve in the division hospital. The number of men for each of these several duties is not yet specified by regulations.

The medical officers of the division number forty-four.

Having considered the personnel, we now turn to the means of transportation. The first conveyance used in carrying the wounded from the field is the litter. The evolution of the hand-litter is an interesting subject, but we shall consider only its recent development in the United States.

During the War of the Rebellion, and until lately in our Regular army, the litter known as the Halstead was in use. This litter was eight feet in length, had folding wooden legs fourteen one-half inches long, and weighed twenty-five pounds. It was a serviceable litter, and only

when we contrast it with our present litter do we remember that the old one was heavy; that its legs were unnecessarily long, apt to become loose and unsteady, and to shut up unexpectedly; that its length and legs prevented its fitting into an ambulance, and that every wounded man on the way to hospital must therefore be lifted from litter to ambulance and from ambulance to litter, thereby wasting time and adding to the patient's suffering.

The present litter of the United States Army, model of 1895, weighs sixteen and one-half pounds. It folds compactly, and may be carried on the shoulder almost as easily as a rifle. The fixed wrought-iron stirrup-shaped legs, or rather feet, raise it four inches from the ground. The side-poles are seven feet six inches long, and the canvas bed six feet long by twenty-two inches wide. Two of these litters can be placed side by side in the regulation ambulance. Litter-slings—bands of worsted webbing to be passed over the shoulders and attached to the handles—are issued to the bearers as a part of their equipment, and are very valuable when the loaded litter is to be carried far.

The corps of trained men and the improved litter just described would seem to perfect the means of transporting the wounded to the first-dressing station. But there is still a weak point in the working of our scheme. Experience has shown that when the litters are wanted at the front in action, they are often far away in the rear with the ambulance train, upon which they are carried. Troops, artillery and ammunition wagons have the right of way when battle is imminent, and ambulances and supply wagons must not encumber the roads and must seek a place of safety. Thus it often happens that during an engagement, and perhaps for some time after, the litters are detained miles away from the battle-field. In the French army the regulations governing the sanitary service, issued in 1893, provide that a one-horse cart, containing litters, material for dressings, etc., follow each battalion of one thousand men on the march and into action. Major Havard, referring to this provision, says: "Whether the cart could follow the regiment into action and reach the place finally selected for the station, is very much doubted by competent authorities even in the French army. In this country, where roads are few and generally bad, it would simply be impossible"[3]—a conclusion which we must accept.

It has been recommended that pack-mules be used to bring litters and medical supplies promptly upon the field.[4] In the war with China, 1894 and 1895, the Japanese successfully used pack-horses for this work. The use of pack-animals seems the natural solution of the difficulty, for they can follow wherever troops go without obstructing the movements of the column. Yet if for any reason pack-animals cannot be secured, men of the sanitary force could be required to carry the litters. Under these circumstances, when troops are in the vicinity of the enemy and battle is probable, the bearers should be ordered before leaving the ambulance train to take the litters, one to every four men, and to carry them

as they march in rear of the regiment. The light, compact litter now in use is easily carried by two men, and in fact is not an excessive burden for one man; and should the wheeled litter-carrier described below, or some similar device, be adopted, the work would be still further lightened.

At the first-dressing station dressings are applied, urgent operations performed, and the wounded made ready for transfer to the ambulance station.

The ambulance station is presumably one thousand or twelve hundred yards beyond the dressing station, established "at some place of security in the rear, or in some convenient building near the field of battle."[1] The site should have a convenient water supply, and if possible it should be easy of access. To this station the wounded are brought in ambulances when practicable. If, however, on account of bad roads, or no roads, or the encumberment of the way by troops and wagons, the ambulances cannot reach the first-dressing station, then litters must be used for the intervening distance.

The ambulance, like the litter, has been evolved from more or less crude beginnings, but it is not yet as well suited to its purpose as is the hand-litter. The pattern now in use in our army, adopted in 1892, carries two patients lying down or eight sitting up. When required for recumbent patients, the removable seats are hung against the sides of the vehicle, leaving a floor space which just holds two litters. The patients are, therefore, carried in the ambulance upon the same litters on which they have been brought from the field. The principal fault of this ambulance, so far as the patients are concerned, is that it is too high, and the joltings of rough roads are thereby exaggerated. It is also too heavy for use on the battle-field, though well adapted to the present needs of our western field service. Moreover, the carrying capacity of the ambulance is too small, as it holds but two recumbent patients, and after a battle the wounded are many and the ambulances comparatively few.

In order to increase their carrying capacity, ambulances have been constructed to hold two tiers of litters for four recumbent patients. Such a vehicle was the Rucker ambulance, used to some extent in the latter part of the War of the Rebellion. The French have two kinds of ambulances, one of which carries two, the other four recumbent patients. The ambulance of the Austrian Red Cross Society, said to be a strong though lightly built vehicle, also carries four litters, two suspended above and two below.

In time of war the need of a light conveyance, which shall hold four recumbent patients, is great, and since it is the part of wisdom in peace to prepare for war, we should do well to exercise our skill and ingenuity in devising such an ambulance.

Wheeled litters, drawn or pushed by hand, have been modeled and remodeled from time to time, but on the chance ground of battle-fields,

often rough and broken, these litters have hitherto been of little use. Attempts have been made to adapt the bicycle to the transportation of the wounded. A device of this character is the "Cycle Ambulance" of the Remington Arms Company. This is made of the framework and wheels of two tandem bicycles placed side by side, and about three feet apart, and connected by a light structure of seamless tubing, upon which is placed a detachable litter. The whole weighs about one hundred and sixty-five pounds, and is propelled by two riders, who occupy the back seats of the tandems. The front seats and pedals are removed. Capt. Theo. E. Lyon, Eighth Regiment, N. G., N. Y., commanding "the bicycle company" of his regiment, made trial of this ambulance during a bicycle campaign with his company on Long Island, in July, 1897. He gives the experience of one day as follows: "The ambulance, with about eighty pounds of baggage on the litter, left Creedmoor at 9 A. M., and arrived at Babylon, a distance of thirty miles, at 4 P. M. The riders were tired out, and the tires of the wheels in such bad condition that I decided not to use the ambulance further on the expedition. It had rained hard nearly all day, and the roads were muddy and heavy except over some macadamized portions. On roads like these, and up hills, it was extremely hard work to push the wheels along. I also found that under these circumstances there was great difficulty in steering the machine. The "cycle ambulance" may prove valuable for use on city streets, but evidently it cannot be considered serviceable for rough and muddy country roads.

A recent invention by Mr. Frederic Remington, the artist, is by far the best adaptation of the wheel to the litter that has yet been made. Mr. Remington, in his campaign experiences with the army on the frontier, has had an eye for the needs of the wounded soldier, as well as for picturesque scouts and warriors. The invention, which he calls a "Litter-carrier," consists of a single wheel, and of a framework to hold the litter. The wheel is twenty-four inches in diameter, and has a steel rim three inches in width, covered with a rubber band; within the rim is a "V"-shaped shield of wood, through which the spokes pass. The shield prevents the accumulation of mud or snow on the rim. The frame is made of steel tubing, upon which rest two three-leaved springs, placed twenty-two inches apart, so that the poles of the regulation litter may rest upon them. The litter is fastened to the carrier by a pin which is attached to the lower side of each litter pole, and passes through a hole in the spring, where it is made fast by a cross-pin. Folding legs are let down to hold the carrier firmly in position when the litter is to be put on or taken off. The litter-carrier thus adjusted, with the litter placed upon it, is about thirty inches in height, and could serve on occasion as an operating table. When the carrier is in motion, the legs fold back and are secured by a simple device to the litter poles. The wheel is readily detached from the frame, and the whole can then be packed in small compass. The model which I have tested weighs

thirty-seven and one-half pounds, but Mr. Remington is confident that the weight can be reduced to about thirty pounds.

The litter-carrier is designed for two bearers, one of whom pulls, while the other pushes; but should one of the bearers become disabled it can be moved by one man alone. Over even ground the loaded carrier is moved with little effort; over rough ground the labor is not excessive, and the broad tread of the rubber-covered wheel and the elasticity of the steel springs make the patient's bed at least endurable, if not wholly comfortable. In case of necessity the carrier and patient can be lifted over ditches or other obstacles. I have tried the carrier under a variety of circumstances, up and down steep slopes, along side-hills, on unpaved roads and across fields, and find it admirably adapted to its purpose. In one of these tests of the litter-carrier a patient weighing one hundred and sixty pounds was carried without stopping a distance of one and one-twelfth miles, mostly over uneven meadow land, in twenty-two minutes, and without fatigue to the bearers. Over the same ground and distance the same patient was carried on a hand-litter in forty-six minutes; eleven minutes of this time were spent in necessary rest, and even then the bearers were very tired at the end of the course. For the long distances from the front to the dressing station, Mr. Remington's litter-carrier promises to be of great value in lightening the labor of the bearers.

At the ambulance station wounds are carefully examined and redressed if necessary, and operations performed as required. Record is made of every patient, and the wounded are fed and cared for until they can be sent on to the field hospital.

The division or field hospital is established at a distance, probably two or three miles from the ambulance station, sufficiently far in the rear to assure, if possible, its permanency undisturbed by the changing lines of battle. The water supply and the character of the ground and roads are also factors in determining the site. From the ambulance station to the division hospital the patients are transported in ambulances or by litter-carrier, and on occasion army wagons or other available vehicles are pressed into this service.

Owing chiefly to faulty organization, the removal of the wounded from the field has hitherto been the least satisfactory work of the army medical service. But conditions have changed, and we are now in position to remedy this defect. Formerly medical men performed their duties subject to the will and convenience of other departments of the army. Now the medical department has full control of its men and material,—enjoys complete autonomy in its own sphere. It has a corps of trained and disciplined men and improved appliances for transportation.

It is held by some authorities that in coming wars it will be impossible to carry away the wounded during the battle, since the bearers would all be killed by the wide and destructive fire of modern arms. Granted that at times this may be so, it does not do away with the need

of preparation for the relief of the wounded at the first practical moment. The value of this preparation does not consist wholly in the actual work accomplished, but also in the confidence given the soldier, that, should he fall, he will be taken care of.

The work of the hospital corps will demand not technical skill alone. It will require military discipline, a training which develops courage, endurance and self-sacrifice, teaches prompt and unquestioning obedience, which, in short, makes a soldier.

In the field hospital the wounded rest for a longer or shorter time, as circumstances or the exigencies of war may decide.

During the War of the Rebellion the wounded were generally sent to hospitals in northern cities as soon as possible after a battle; long journeys by rail and boat were thus made necessary. Many invalids were carried in freight cars, upon bed-sacks, or mattresses, or blankets, which were placed on hay, straw, dry leaves, or pine boughs strewn over the floor. Passenger cars were converted into hospital cars, and as the war progressed special hospital cars were constructed and hospital trains organized, with kitchen, dispensary and store-room. The interior arrangement of the cars varied, but in the main two plans were in use. In one, litters were secured to upright posts, which were placed along the central passageway or aisle of the cars; to these posts on one side, and to the sides of the cars on the other, were attached elastic rubber rings, by which the handles of the litters were held. The litters were placed in two tiers, one above the other, on either side of the aisle. In the other plan the arrangements more nearly resembled the ordinary sleeping-car, the hand-litter not being used. In the subsequent development of the hospital car in other countries, two ends have generally been kept in view—to provide simple fixtures which can be readily adjusted to any car when needed, and to utilize the hand-litter. Cars built exclusively for military hospital service are a costly and wasteful investment; in peace they are not wanted; in war, when wanted they may not be at hand. A method is therefore desirable by which an ordinary car can readily be converted into a hospital car. The use of the hand-litter obviates the necessity of transferring the patient from one bed to another, so that throughout the changes of his journey, whether by car or by ambulance, he remains undisturbed upon his litter.

In the various European countries, fixtures for extemporizing hospital cars are kept on hand in the store-houses of the government or of the aid societies. In Germany the system devised by Grund is in use. It consists of semi-elliptical plate springs, three feet long, which are fastened to the floor of the car when needed and connected by wooden cross-bars. Upon the cross-bars field litters are placed. In Count Beaufort's system, which is practically the same as Grund's, a portable case with springs receives the litter. Coiled springs are also used. These are attached to the top of the car and litters suspended from them. The French make use of a portable iron framework, from which litters

are suspended by spiral springs. In Austria iron standards resembling a small bed-room towel-rack are screwed into the floor of the car, and on these standards litters are laid. The elastic rubber ring for suspension, after long trial, appears to have presented insurmountable defects, and to have been abandoned.

Austria is, I believe, the only country which keeps special hospital or ambulance trains ready against the outbreak of war. The trains are constructed and maintained, not by the government, but by the Bohemian branch of the Knights of Malta, who in Austria still retain the estates of which in most other countries they have been deprived. Each train consists of ten cars for the wounded, a car for the medical officers and the knight representative of the order, a kitchen, a dining-car for the staff and convalescents, a dispensary and two store-cars. The trains are kept ready for the Austrian War Office by the Knights of Malta. A definite agreement exists which defines the duties of the order, and the rights of the government.

Railway transportation of the wounded in war has been necessary in the past, and doubtless will be needed in the future. But the interests of the wounded would be subserved if a greater degree of permanency could be given to the field hospital. In the treatment of fractured bones, of wounds of the joints, and of the large cavities—of all severe injuries—rest is most important. The surgical history of the War of the Rebellion, if related in detail, would tell of much suffering and of death as the result of long days and nights of travel endured by severely wounded men.

My first army experience was during the summer of 1864, in the general hospital of 1200 beds at Fort Schuyler, New York Harbor. The wards were filled from the distant battle-fields of the Chickahominy and the vicinity of Petersburgh. A large proportion of the patients arrived with their wounds swollen and inflamed, their bodies wasted by fever, their strength exhausted. Pyæmia was frequent, and here I made my first and only acquaintance with hospital gangrene. As an instance of the exhaustion experienced by these maimed travelers, I recall the case of a soldier who had undergone an amputation of the foot. The boat arrived late at night, and the wounded were at once taken ashore. While on the way to the hospital this long-suffering patient fainted, and when he reached the ward, being apparently lifeless, he was carried on to the dead-house. A little later another body was brought to this place of last resort. As I was about to close the door the light from the lantern, falling upon the face of the man first brought in, showed his eyes open and fixed upon me in mute appeal. He could speak only in a whisper, and his powers seemed utterly spent, but by careful nursing he was brought back to life. Doubtless he could tell a gruesome tale of his fortnight's travels from battle-field to dead-house.

It is perhaps simpler and more convenient to carry patients to distant hospitals than to bring hospitals to patients, but undoubtedly

many lives might have been saved by giving to the wounded rest and care near the fields on which they fell. The experience gained during the war showed that the treatment of the wounded in tents throughout the milder portion of the year was attended by the very best results. In winter, in cold climates, there are no doubt disadvantages connected with hospitals of tents, but there are other kinds of shelter, both light and portable, which can be warmed more readily and equably than tents. One devised by Capt. Doecker, of the Royal Danish Army, has been especially commended. It consists of light wooden frames covered with a species of felt, called Carton felt, and lined with canvas.

We have now followed the route of the wounded soldier from firing-line to hospital. Though such a journey may never be painless, yet the measures taken to relieve suffering and to save life have at least kept pace with the inventions contrived to wound and to kill.

GOVERNOR'S ISLAND, NEW YORK.

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Military Notes.

THE BRITISH ARTICLES OF WAR OF 1625, OR 1629.

MR. CHARLES M. CLODE, in his work on "Military and Martial Law," gives a description of British Articles of War of 1629, but he also, in the same place, refers to his work on the "Military Forces of the Crown," in which articles of war of 1625 are mentioned, but none of 1629. In his book on military law the articles of 1629 are referred to as being, in manuscript, in the Record Office. Being issued after those of Gustavus Adolphus, of 1621, and before those of the Earl of Arundel, of 1639, these articles, whether of 1625 or 1629, were put forth at a most interesting period of the development of military law in England. After much search, made through the courtesy of Lieutenant J. C. Colwell, Naval Attaché of the United States Embassy in London, the Articles were found in the Public Record Office of the British Museum, and comparison with Mr. Clode's description shows that they must have been the Articles which he had before him. Lieutenant Colwell writes in regard to them as follows:

"I have made further enquiries regarding the Articles of War, copies of which were sent you, and find that when the fire occurred in 1834, partly burning the Archives of both the Lords and Commons, the papers that were saved were thrown into great confusion; a mass of these papers were subsequently rearranged, and the Articles referred to were preserved in a volume of undated papers in the Public Record Office and is in the 'State Papers,' Domestic, Charles I., Vol. 13, No. 41. When these papers were compiled, the document in question was put as being presumably of date 1625; the gentleman that made the searches, however, is inclined to the belief that it is more probably of date 1629, but no dated letter or paper could be found and the date could not be fixed with any certainty."

The following is a copy of the Articles.

G. NORMAN LIEBER.

Martiall Lawes ordained and instituted by his Matie wth the advice of the Counsell of warr for the gouvernment and good ordering of the troopes in this Kingdome, either being in an Army or in Regiments, or in single Companies to punish the malitious and wicked, And to defende the innocent, according to the custome of all well gouverned Kingdomes.

Hee that blasphemeth, or is knowne to be a common swearer, to have his toung bored through wth a hot Iron.

Hee that is knowne to be a drunckard, is first to bee admonished And for the next to be put in prison, And to be kept there at bread And water seaven daies. And his meanes that while that is overplus, to be bestowed on some sick or poore Soldier.

That if anie Soldier be druncke on his garde, or on the day hee should exercise, if he be an Officer he is to be Casseered; if a Soldier, he is to be seaven daies at bread And water, as is before said. And if that doe no good, he is to have the Strappadoe, either more or Lesse.

That if anie shall absent himself from the Church, to have the same punishment of bread And water.

That if anie Soldier or Officer doe abuse either man or woman, the party grieved shall goe to the Officer y^t^ Commands in Chief, Let him be Captaine or more then a Captaine, or Lieutenant or Ensigne, if none of these then to the next Justice of the peace, if the cause require, And desire him to have him forth coming, and to write to the Officer of the Offender, to let him knowe of the Offence, then that chief Officer must crave Justice of a Counsell of warr, according to the Offence, either to aske the partie forgivenesse, or to punish it w^th^ imprisonment or the Strappadoe, or w^th^ more or Lesse as the fault requireth.

If anie Soldier doe shed bloud, or maime anie of his fellowes, or anie other that is no Soldier, hee must bee more or lesse punished till the party offended be satisfied according to the punishment before named, and at the direccon of the Officer, if there be no Marshall Court in that place, he must be brought where there is one.

If anie Soldier doe force anie woman or maide he is to suffer death.

If he steale anie thing that is of note hee is to suffer death, if of small value hee must be more or lesse punished, and imprisoned untill hee make satisfaccon, And to stande w^th^ a paper on his breast, where there shalbe written the Offence, and if it be done in a Market Towne, or nigh, then to have it on a Market day.

That if anie Soldier doe give anie hinderance to Market folkes passage, to be severely punished, but if they take anie thing from them, to be punished w^th^ death w^thout^ mercie.

That no Soldier be seene w^thout^ his sworde, And if hee will take no warning then to be put in prison.

That no Soldier be found a mile from his Garrison or Lodging w^thout^ leave of his Officer in wryting, upon paine of imprisonment.

If a Soldier have leave And doe not returne w^th^in the tyme limited, w^thout^ some sufficient excuse, And then to bring some sufficient testimonie of it, he must be punished as before.

If anie Soldier doe sell anie parte of his Cloathes or Armes, to one another, or to anie other hee shall have the afore said punishment, and the party that doth receive it shall loose his money, for they are not his but his Ma^s^.

That if anie Officer of a Towne shall see a Soldier passe, w^thout^ asking him where his passe and forecaste is, And if the Soldier have no

passe, then is hee to send him from Constable to Constable till he come to his Officer, If he doe not his dutie herein to his Maiestie, hee must be presented to the Lords.

That anie Soldier that doth strike his Officer, or anie other Officer, or doth but make shewe of it, as by laying his hande upon his sworde, or give him ill language, shall suffer death wthout mercie.

That if anie Soldier doe use anie uncivile speeches either against his Maiesty or anie other person in authoritie or anie other waies, is to be punished wthout mercie.

That no man shall goe of his garde wthout leave of his chief Officer that there commandeth, wthout due punishment, such as have bene fore named.

That no Sentinell be founde sleeping upon his garde upon paine of death.

All other disorders whatsoever, are to be punished, as these formerly mentioned, though not formerly nominated.

That all Soldiers And Officers doe take an Oth as the Custome is, in all Countries, to be faithfull to his Ma^{ties} service, both in thought worde and deede, and not to conceal anie thing that they shall heare or see, that is not for his Ma^{ts} service And honor, and to obey all his Commandements.

That there be authoritie given to anie three or more of the Commissioners, to call a Marshall Courte, And sit in Comission, to heare, Judge, And determine anie fact done by Soldiers, but to have no power to put to death, till they have advertised the Generall, that shall have authoritie of Life and death, for such troupes as he shall commande.

To have in every Market place a Gibbet, And Strappadoe, for the sight of such a remembrancer, will doe good in a wicked mynde.

That there be a Provost appointed in every Regiment, when the Regiments shalbe full, and a prison ordained for Soldiers a parte from anie other.

The Provost must have a horse allowed him, And some Soldiers to attende him, And all the rest commanded to obey him, And assist him, otherwise the service will suffer, for hee is but one man, and must correct manie, And therefore cannot be beloved. And hee must be riding from one Garrison to another, to see that the Soldiers doe no outrage nor scath about in the Countrie.

And these Orders are helde in all Countries where true discipline is esteemed.

THE CARE OF TROOPS IN THE TROPICS.

Allusion has heretofore been made in these columns to the adverse criticisms passed upon the War Department in reference to its care of our troops. Doubtless there are, or were, shortcomings, to be credited largely to hurried mobilization and the necessity for creating resources that before were non-existent; but such are sure, in great measure, at

least, to regulate themselves in consonance with the knowledge derived from experience. Experience, however, is often a costly means of acquiring knowledge; and now the invasion of Cuba is *fait accompli*, coupled with the fact that its climatic conditions and surroundings are quite different from anything hitherto experienced by either our regulars or volunteers, some of the late lessons taught our Anglo-Saxon brethren across the water in their occupation of tropical regions may acquire new values and afford new opportunities for application.

Formerly, the west coast of Africa excepted, the West Indian stations of the British army were regarded as the most malignant and deadly within the limits of the empire. To-day all occupied by white troops are remarkable for their cleanly, healthy, and salubrious character. Much the same may be said of the stations in the Orient, those of Central India more particularly, which region has a certain similitude to Cuba as regards topography; both lie between the 20th parallel of latitude and the Tropic of Cancer, and both alike present successive areas of low and alluvial soil, tableland, and hill country.

It has been declared that most of the ills of the soldier are of his own making; but, however true this may be, it in no way excuses military executives for shortcomings, and notoriously, these very shortcomings in many instances have slain more men than either miasma or bullets.

The routine assignment of the regiments in the British service constitutes no small factor in acclimatization. Except in dire emergency, this is progressive: The regiments that embark at Southampton proceed to Gibraltar, Malta, and Cyprus, and from thence after a time are distributed to the Far East. The return is a reversal of the outgoing, the regiments being, however, differently distributed; the next they, or a portion thereof, are forwarded to Jamaica, Barbadoes, Trinidad, and St. Lucia; a few, perhaps, reach Halifax before returning to England. Black troops—the West India regiments—are exclusively employed as garrisons at Demerara, Honduras, and on the African West Coast, and not infrequently in Bermuda, and occasionally at St. Lucia.

During the latter part of the last century and the early years of the present one, the death-rate among the white troops in the two Indies was appalling. During a service of five years, certain regiments, 1000 strong, lost all their original members; and one regiment, 860 strong, stationed at Apostle's Point—sometimes termed "Angel's Point"—at the entrance to Port Royal, Jamaica, lost more than one-third its strength in less than twelve months. The average mortality in Central India from 1838 to 1856 was 79.20 per thousand, and in the West Indies nearly or quite as great, though accurate statistics are not obtainable. In 1860 the mortality in India had fallen to 31.27, and in 1888 was but 15.73; in the West Indies for 1878 it was 16.18, which fell to 3.44 in 1888. From the latter figures, it would appear the Antilles are more healthy to Europeans than India, and this is true; but it must also be

remembered the stations in the former are few, and being no longer of strategical importance, are located in the most salubrious situations. The conditions in the East are widely different: regiments are obliged to do tours of duty in low-lying miasmatic districts, as well as in the more salubrious tablelands and hills, such being due to "exigencies of the service"; further, in India the population is so dense as to induce unsanitary surroundings that, by reason of an universal fatalistic belief and religious prejudices, are difficult if not impossible of eradication.

Long-continued high temperatures; alternations of great atmospheric dryness and moisture; rapidly-moving, perhaps dry and hot, air—all are common conditions in the tropics; and when to these is added the development of malaria, it is evident those accustomed to a temperate climate cannot support such surroundings without material detriment to health, except most extraordinary measures for protection are taken. For these reasons, if no other, the sanitary and hygienic conditions governing the soldier require careful but firm enforcement.

The tablelands and hills, being less malarious, and affording a more pure supply of air, should in so far as possible be selected for camps; further, in these situations liver maladies are uncommon, and intestinal fluxes neither so frequent nor violent. British military authorities lay great stress on the foregoing, and camps and barracks are located, in as far as opportunities permit, in consonance therewith.

Formerly the barracks employed for troops in the tropics were exact prototypes of the quadrangular structures that obtained in England—crowded, ill ventilated, stuffy, and hot; notoriously, at one time, the convict barracks at Bermuda were far superior to the quarters provided for the troops. To-day, the tropical barracks are large, commodious, two-storied buildings, elevated on arches of masonry several feet above the ground, and the walls exposed to the sun shadowed by wide verandas; there is also a double roof, with several feet of intervening space and permitting free circulation of air. Only one-half company is allowed in any one building, and only 16 to 20 men may occupy the same room, and to each is secured not less than 90 feet of superficial space and 1800 feet of cubic space; besides thorough cross ventilation is provided for. Again, in tropical barracks no room is less than 24 feet wide and 20 feet between floors and ceilings. In some portions of India the barracks fairly deserve the titles of "palaces"—notably those at Allahabad—bestowed upon them by the natives, and they also afford ample evidence of the desire of the authorities to properly care for and conserve the health of "the nation's defenders."

When ordered for tropical service, the English soldier is given an entire new outfit of clothing. Drill trousers and cotton jackets are the rule, perhaps also an extra tunic of scarlet serge. In India complete suits of khaki (a native gray or dust-colored cloth) are commonly worn, the regulation uniform being donned only when the conditions of climate and temperature demand. Many of the officers wear tunics of grass-

cloth. The use of the kammerband, or wide flannel bandage, over the abdomen (preferably next to the skin) is general, and in fact often enforced, as constituting a wise precaution against the intestinal fluxes that are so prevalent and against a chilling that predisposes to malarial attacks. For Central African service a brown drill uniform, similar to that adopted by the United States for the campaign in Cuba, is served out—a uniform that originated with the Cape Mounted Rifles; but the felt hat and leggins were speedily abandoned as unsuitable and cumbersome, and replaced by ankle boots and a bamboo wicker or a "Tuson" helmet. The bamboo helmet, which is light, comfortable, durable, and in every way effective, is covered with cloth and provided with a puggery; the "Tuson" consists of two bodies, one within the other, forming a complete air chamber, not only in the crown, but in the brim as well. Manifestly, the head covering of the soldier in the tropics should present the least possible surface to the wind, should not embody a single half-ounce of superfluous weight (hence should not be permeable to water), offer the greatest facilities for coolness, and yet not be cumbersome—conditions that cannot be filled by a structure of felt. Leggins, if of leather, and not of good quality, lose their suppleness and press on the ankles and instep; so also do those of cloth, in less degree, when they have been wet a few times and become saturated with dust—they only possess the advantage that at the end of a march they can be at once removed and cleaned, a bit of care that cannot often be inculcated or enforced.

Ankle boots with good serviceable tongues, and made to either lace or buckle, are now exclusively used by the British army, and have even been adopted by officers; they can be made to fasten the bottoms of the trousers—purposely made short—to the ankles in a way to exclude dust. English regulation boots are made on the principles laid down by Camper, Meyer, and others, and they are had in thirty-two sizes—eight in length and four in breadth—with very low, broad heels. The inner line is straight, so as not to push outward the great toe in any degree, and there is a bulging over the root of the same toe to allow for easy play of the joint; across the tread and toes it is very broad, so that lateral expansion may not be impeded. Great care is taken in the inspection of boots, which are of the very best quality and made in a specified way. The size is proved by standard measure, the excellence of the leather and quality of the sewing by selecting at random a certain number of each lot and cutting them up, when the slightest defect in one entails rejection of all. It is required there be not less than eight stitches to the inch, and even the number of strands, their thickness, and the waxing are carefully set forth in the specifications. Practically the same inspection governs the acceptance of clothing, which is always of the very best quality and altered by the company or regimental tailors to accurately fit the individual, as much care being taken in this regard as if preparing a suit for a Regent Street dandy. It is the attention to even the

more minute details of uniform that has given Tommy Atkins his reputation for smartness and neatness.

The daily ration of the British soldier in the tropics consists primarily of 24 ounces of fresh meat, 16 ounces each of bread and potatoes, 4 ounces of rice, 2.5 sugar, 0.71 tea, and 0.66 salt, besides pepper, vinegar, beer, etc. If salt meat is served, the amount is one-third less, but salt meats are abjured as much as possible, since scurvy is more prevalent in the tropics than elsewhere and, moreover, more fatal. Fresh vegetables are largely substituted for part of the potatoes and all the rice ration; lime juice is frequently served; and a convenient canteen at which all articles are sold at absolute cost price is always available, and even arranged for on a march. Experience has proved that the use of alcoholic beverages is to be condemned in the hot climates and that even wines must be employed with moderation; but light wines, such as clarets, in reasonable quantity, diluted with water, are beneficial rather than otherwise; but as the private soldier cannot indulge in wine, he is provided with a light beer, but never in amounts exceeding one quart daily. The native liquors of both the East and West Indies are all vile, often drugged, and usually mixed with cayenne or other hot or pungent substances. The cheap rum (caña—"nigger rum") of the Antilles, derived from sugar and cane waste, is especially pernicious.—*Scientific American*.

THE ARMY MEDICAL STAFF.

The Marquis of Lansdowne has announced the new scheme of the War Office for dealing with the Army Medical Staff. He admitted that there was no department of the public service which owed more to and depended more upon the members of the medical profession than the army. With every year that passes engines of destruction are brought to a greater pitch of perfection. The skill and devotion of the medical service were, he said, the correctives of our modern ruthlessness. The army is proud that it contains a number of officers who belong to the medical profession, but who are none the less soldiers in the fullest sense of the word, wearing the Queen's uniform, holding her Majesty's commission, ready to take their share of the risk and hardship of warfare. Lord Lansdowne went on to say that it was his determination that there should be no failure either in theory or in practice to treat medical officers with the respect to which they were entitled. He counted upon this point, because he had observed with very keen regret that there had existed for some time past a certain estrangement between the army and the profession. This want of confidence has had for its result that the army has been unable to attract to the service the number of candidates and the class of candidate which it was the desire of the authorities, to see serving in the medical staff. Mistakes had been made on both sides, but the War Office has now determined that there should be no cause of complaint on its side. It was proposed to deal thoroughly with a question in regard to which not only the medical staff of the army but

the medical profession generally felt very strongly—the rank and status of the Army Medical Staff. It has sometimes been said, What does rank matter? The title of doctor or surgeon by itself may be regarded as a title which any one would be proud to wear without further adjuncts. But in the army, rank is the outward and visible sign of consideration and authority, and it is necessary in the military profession that a man should have a military stamp to distinguish him and to secure him his proper place among his comrades. It has now been decided to form out of the Army Medical Staff and the Medical Staff Corps a corps, the officers of which will bear the same military titles as other officers of the army—always, of course, upon the clear understanding that those titles do not confer upon them the right to command outside it. These titles will be given up to the rank of colonel. It was urged that the authorities should not stop there, but go on to the rank of general officer. But there are conclusive reasons against this. The policy of the War Office is to restrict, as closely as it can, the number of officers bearing the title of general, and to insist that no one shall rise to that rank unless he is required to fill one of a limited number of appointments, all of which will involve general command in the army and fitness on occasion to command troops in the field. No departmental officers will, under this system, be able to reach the rank of general officer, and it would be impossible to confer it upon members of the medical staff. Above the rank of colonel will be that of surgeon-general, with the rank and precedence of a major-general in the army. Her Majesty has been pleased to approve of the formation of the "Royal Army Medical Corps," from the 1st July.—*Journal R. U. S. Institute.*

THE STRENGTH OF THE BRITISH ARMY.

In anticipation of the General Annual Return of the British Army, a Preliminary Return for the year 1897, prepared by order of the Commander-in-chief, for the information of the Secretary of State for War, has just been published. The average strength of the entire army during the year was 219,283 of all ranks. Individually, the figures are: Household cavalry, 1312; cavalry of the Line, 18,049; horse artillery, 3723; field artillery, 14,263; mountain artillery, 1446; garrison artillery, 17,545; Royal Engineers, 7801; Foot Guards, 6120; infantry of the Line, 135,467; Colonial corps, 5412; Army Service Corps, 3590; Army Ordnance Corps, 1310; Medical Staff Corps. 2667; Army Pay Corps, 578. Taken out by ranks, the total already mentioned shows that there were 7757 officers, 918 warrant officers, 14,189 sergeants, 3429 trumpeters, drummers, and buglers, and 192,990 of the rank and file. Of the total the average of officers and men serving at home was 102,155, and abroad 117,128. On the 1st of January the number of effectives of the rank and file of all arms was 194,705. The complete establishment in these grades was 195,304, leaving only 599 as "wanting to complete." The garrison artillery on that date were deficient of 383; the Royal En-

gineers, 111 ; the Foot Guards, 240; infantry of the Line, 466; Colonial Corps, 179; Army Ordnance Corps, 42 ; and Army Pay Corps, four. In several corps, notably the field artillery and cavalry of the Line, a number of supernumeraries were borne on the strength. Of all arms there were 212,231 effective non-commissioned officers and men on January 1, 1897, while on January 1 this year the number was 212,393, a net increase of 162. Of the 33,771 recruits who were finally approved for the army last year 26,284 were raised in England ; 3561 in Scotland; and 3926 in Ireland. Of the recruits 1367 were under 17 years of age; 189 of 17 years and under 18; 16,083 of 18 years and under 19 years; and 7405 of 20 years and under 21. To men finally discharged from the army 1665 permanent pensions were granted, and temporary pensions to 1042. In the year 16,804 men were transferred from the regular army to the First Class Army Reserve. The number of desertions was 1924, a percentage of net loss to recruits of 5.5. Of the entire army 5239 men were tried by courts-martial for various offenses. Of minor punishments 106,139 were inflicted, a percentage of 109 to the average strength. In the first class of the army reserve on the 1st of January there were 82,005 men—2005 in excess of the establishment; in the second class, which has an establishment of 100 only, there were 58 men ; the militia comprised 114,588 men, or 18,914 less than the authorized strength. The militia reserve stood at 31,049 men, an excess over the establishment of 1049.—*United Service Gazette.*

THE ANCIENTS' HOSPITALS.

A very interesting and pleasing discovery is announced from Baden, near Zurich. The learned have been discussing for ages whether anything in the way of hospitals was known to the ancients—it is not to be said that they have been disputing, for there was not material enough hitherto to support a lively argument. One might read the whole volume of Greek and Roman literature, carefully, too, without noticing one passage that might be interpreted as an allusion to a hospital. The works of Hippocrates could not fail to speak of them surely, if any existed ; but nothing is there beyond a reference to the notes of "cases" observed in the Temple of Æsculapius. So it is generally assumed that there were no hospitals in those days ; the Æsclepia were "baths" with massage treatment. Scholars who hold to the other opinion can adduce only hints in its favor. But now we hear that one has actually been discovered at Baden, containing "fourteen rooms, supplied with many kinds of medical, pharmaceutical, and surgical apparatus, probes, tubes, pincers, cauterizing instruments, and even a collection of safety pins for bandaging wounds"—but these things are familiar. "There are also medicine spoons in bone and silver, measuring vessels, jars, and pots for ointment, some still containing traces of the ointment used." The latest date of the coins found appears to be in the reign of Hadrian. Probably it was a military hospital, for this was the station

of the Seventh and Eighth Legions. But the find is certainly not less interesting on that account, for the army medical service of Rome and Greece is one of the deepest mysteries of archæology. Cæsar refers only once to his regimental surgeons—is there a single distinct allusion elsewhere? We hail with puzzled gratitude the casual remark of Xenophon that the Spartans sent their doctors to the rear when a fight impended—but we look vainly for more information from him or anybody else.—*Scientific American.*

Comment and Criticism.

"Telescopic Sights."

1st Lieut. Geo. Montgomery, Ord. Dept., U. S. A.

I QUITE concur with Lieutenant Horn's views concerning the necessity for a field-gun telescopic sight for ranges exceeding 2500 yards. A telescopic sight enables objects otherwise invisible, or very nearly so to the naked eye, to be distinctly seen, and in addition, practically makes every man in a battery a gunner by the simplicity with which accurate laying can be accomplished. The increased power of vision is evident to everybody, and to many it is considered the principal claim for a telescopic sight; but in such a sight, when the telescope is properly focussed for the individual gunner, he lays the intersection of the crosswires exactly on the part of the image of the object sighted. There is no parallax, and therefore no personal error.

A telescopic sight for field service should be simple, strong and compact. The telescope should give a large field, with no loss of light, other than by absorption in the glasses, and a power compatible with the above demands.

There is now being issued to the sea-coast service, a telescopic sight with erect image, which is an admirable one for field-gun service. It has the disadvantage that the method giving deflection is exactly the opposite of that for the open tangent sight. The amount of deflection given by that particular sight is more than is desired for a field-gun sight—but that can hardly be considered an objection to it. Should an inverted telescope be used, the direction of the deflection movement is the same for the two kinds of sights.

This sight is rigid and compact, and seldom loses its adjustment. The field of view is large, about 5½°, and the power is 8⅛, which with a diameter of 1.2 inches for the objective, gives the maximum illumination with the most unfavorable light during day time. A power of 15, is out of the question. Such a power would call for an objective with a diameter of 2.25 inches—which would make the sight a very cumbersome affair, and the field would be only about 3° 20′. Of course, a power of 15 could be used in the present sight, but in addition to the reduction in field, there would be such a loss of light due to the increased magnification, that only in the sunlight could the best results be obtained from such a telescope.

This sight is attached to the right trunnion and can be used in conjunction with the open sight. In addition, the telescopic sight can be used for reverse laying, which certainly must be used in field-gun laying, when the guns are concealed behind a crest.

Though telescopic sights are known to possess these advantages, it is extremely doubtful until the introduction of smokeless powder, whether they can be used in actual service with success. Smoke is the enemy of telescopes, and I have found from actual experience that a slight smoke will render observation through a telescope, extremely difficult, and gun-laying under such conditions, would be very tedious, and irritating to the gunner. Besides, telescopic

sights are necessarily very delicate as compared with the present tangent sight. In the particular telescopic sights to which I referred, the cross level and the axis of the sight trunnions are the vulnerable features, and the greatest care must be exercised at all times to keep the sights in perfect adjustment. This can be facilitated by having in each battery a spare sight which would be used solely as a standard to test the others.

I wonder if Lieutenant Horn ever found from actual trial that he could shoot the field-gun within a barn door at a two-mile range. It has never been accomplished at the Sandy Hook Proving Ground, using a telescopic sight, and smokeless powder giving the best ballistic results. The best records for the 3.2 R. F. field-gun were a mean deviation from the centre of impact of 2.22 feet for a one mile, and 5.57 feet for a 3000 yard range.

Capt. H. L. Harris, 1st U. S. Artillery.

Captain (then Lieutenant) C. L. Best, 1st U. S. Artillery, invented a telescopic sight for field-guns, which was made and tested at Fort Hamilton. The editor has not been able to obtain the results of the test.

It would appear that a trunnion sight (telescopic) for a field-gun was a necessity. It is not thought that any other position can be provided for it that will give general satisfaction. That the field-gun should be provided with a telescopic sight does not seem to admit of question.

Announcement.

IN order to facilitate the prompt delivery of the JOURNAL, members are requested to notify this office of every change of address.

Prize Essay of Infantry Society

FOR 1899.

"The Infantry of the United States Army. How Should it be Recruited, Equipped, Organized, Supplied and Utilized."

Essays should be in the hands of the Secretary and Treasurer, U. S. Infantry Society, Fort Leavenworth, Kansas, before January 1, 1899.

The conditions of the competition can be learned from the Secretary.

Announcement.

AS indicated on page 370 of the JOURNAL, the time in which essays, sent in competition for the prize of 1898, may be submitted, has been extended to January 1st, 1899.

Extract from the Minutes of a stated meeting of the Executive Council, Military Service Institution, held at Governor's Island, N. Y. H., July 13th, 1898.

On motion, duly seconded, the following Resolutions were unanimously adopted:

WHEREAS; It is officially announced that James Fornance, Captain Thirteenth Infantry, United States Army, was killed in action while gallantly leading his company in the assault upon the fortified city of Santiago de Cuba, July 1st, 1898, and

WHEREAS; Captain Fornance was for a long time the Secretary of the Military Service Institution; therefore, be it

RESOLVED; that the Executive Council desires to place upon record in the minutes of this meeting, its deep sense of the valuable and disinterested service rendered by Captain Fornance to the Institution, and through it to the military service of the country; its appreciation of his excellent qualities and high character as an officer and gentleman; and its unfeigned sorrow at the death of such a gallant soldier.

RESOLVED; that these resolutions duly attested be published in the forthcoming number of the Journal of the Military Service Institution, and that copies thereof be transmitted to the family of the deceased.

The Military Service Institution.

President.

Major-General NELSON A. MILES, U. S. Army.

Resident Vice-Presidents.

Major-General WESLEY MERRITT, U. S. A. — Bvt. Brig.-Gen. T. F. RODENBOUGH, U. S. A.

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Capt. H. L. HARRIS, 1st U. S. Artillery.

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Term ending 1903.

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GILLESPIE, GEO. L., Brig.-Gen. U. S. Vols.
GLENN, Geo. E., Col. A. P. M. G.
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Term ending 1901.

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Term ending 1899.

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ANDREWS, GEO., Major A. G. Dept.
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NOTE.—Checks and Money Orders should be drawn to order of, and addressed to, "The Treasurer Military Service Institution," Governor's Island, New York Harbor. Yearly dues include Journal.

Changes of address should be reported promptly.

Prize Essay—1898.

TIME HAS BEEN EXTENDED TO JANUARY 1st, 1899.

I.—The following Resolution of Council is published for the information of all concerned:

Resolved, That a Prize of a Gold Medal, together with $100 and a Certificate of Life Membership, be offered annually by THE MILITARY SERVICE INSTITUTION OF THE UNITED STATES for the best essay on a military topic of current interest, the subject to be selected by the Executive Council, and $50 to the first honorably mentioned essay. The Prizes will be awarded under the following conditions:

1. Competition to be open to all persons eligible to membership.

2. Each competitor shall send three copies of his Essay in a sealed envelope to the Secretary *on or before September* 1, 1898. The Essay must be strictly anonymous, but the author shall adopt some *nom de plume* and sign the same to the Essay, followed by a figure corresponding with the number of pages of MS.; a sealed envelope bearing the *nom de plume* on the outside, and enclosing full name and address, should accompany the Essay. This envelope to be opened in the presence of the Council after the decision of the Board of Award has been received.

3. The prize shall be awarded upon the recommendation of a Board consisting of three suitable persons chosen by the Executive Council, who will be requested to designate *the Essay deemed worthy of the prize;* and also in their order of merit those deserving of honorable mention.

In determining the essay worthy of the prize, the Board will be requested to consider its professional excellence, usefulness and valuable originality, as of the first importance, and its literary merit as of the second importance. Should members of the Board determine that no essay is worthy of the prize, they may designate one or more essays simply as of honorable mention; in either case, they will be requested to designate one essay as first honorable mention. Should the Board deem proper, it may recommend neither prize nor honorable mention. Should it be so desired, the recommendation of individual members will be considered as confidential by the Council.

4. The successful Essay shall be published in the Journal of the Institution, and the Essays deemed worthy of honorable mention shall be read before the Institution, or published, at the discretion of the Council.

5. Essays must not exceed twenty thousand words, or fifty pages of the size and style of the JOURNAL (exclusive of tables).

II.—The Subject selected by the Council at a meeting held Sept. 11, 1897, for the Prize Essay of 1898, is

"*OUR WATER BOUNDARIES AND OUR INTERIOR WATER-WAYS; HOW TO UTILIZE AND DEFEND THEM; THEIR INFLUENCE IN CASE OF INVASION.*"

III.—The gentlemen chosen by the Council to constitute the Board of Award for the year 1898 are:

REAR ADMIRAL BANCROFT GHERARDI, U. S. N.
BRIG. GENERAL WILLIAM P. CRAIGHILL, U. S. A.
HONORABLE JOSEPH H. OUTHWAITE.

GOVERNOR'S ISLAND,
Nov. 1, 1897.

JAMES FORNANCE,
Secretary.